THE HEATING AND VENTILATING MAGAZINE

1123 BROADWAY NEW YORK FEBRUARY, 1913

Vacuum Cleaning

By MAXWELL S. COOLEY,

Supervising Architect's Office, Washington, D. C.

3—VACUUM CLEANING TESTS.

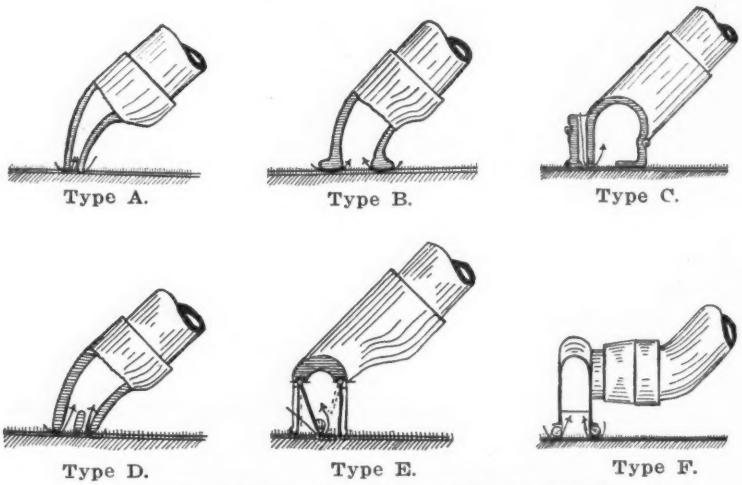
In order to obtain a standard for use in making tests a carpet which had been in actual use for a number of years on the floors of the old United States Mint Building at Philadelphia and receiving the ordinary amount of cleaning was procured. This was a Brussels carpet, with glue-sized back, containing about 20 sq. yds. It was divided into three approximately equal parts.

An indicator was attached to the vacuum pump for taking air measurements. It was found that there was considerable leakage of air into the system through the connections to the separators and at other points, therefore the pump was operated with 22 ins. of vacuum in the separator and a card taken with all outlets closed and the amount of leakage noted. During the tests this degree of vacuum was always maintained in the separators and pipe lines and the vacuum at the hose cock was controlled by throttling at this point. This manner of making tests gave a practically constant leakage, which was deducted from the quantitites shown by the indicator cards taken with the renovator in operation.

Each piece of carpet was cleaned during six periods of one minute each, using a different vacuum at the tool for each piece of carpet. The carpets were weighed at the beginning of the test and after each one minute period. At the con-

clusion of these each carpet was cleaned until no change of weight occurred after 2 min. cleaning. They were then considered as being 100% clean and this standard was used as a basis for computing the percentage of dirt removal. A renovator of Type C was used in these tests.

Shortly afterward a similar test was made on a dirty carpet of 4.6 sq. yds. area using a renovator of Type F.



TYPES OF RENOVATORS USED IN TESTS.

This carpet was also a Brussels, with glue-sized back, which had been in use in the shoe department of a large department store in Hartford, Conn., and, when received, it was surface clean.

The results of the above tests are shown in the following table together with the results of cleaning portions of the Philadelphia carpet with a Type A renovator:

TABLE 1—TESTS ON TWO BRUSSELS CARPETS.

Type of renovator.....	A		C			F
Vacuum in renovator, in.....	2	4	1	2½	4	3½
Air, cu. ft. per min.....	22	32	30	43	50	66
Material removed, per cent. of total:						
1 min.	41	52	37	39	47	40
2 min.	60	78	52	59	63	60
3 min.	77	90	59	66	71	90
4 min.	85	100	61	72	83	100
5 min.	100	..	66	75	87	..
6 min.	..	..	67	82	90	..

The results of the best run on each of the cleaners is shown graphically in Fig. 1. This shows that Types A and F renovators are about equally efficient as dust removers, while Type F renovator required twice as much air as Type A and that Type C renovator is less efficient than either of the others while requiring nearly as much air as Type F.

These carpets contained approximately 2 oz. of dust per square yard, none of which was visible on the surface, and they were probably as clean as the average carpet after being gone over with a carpet sweeper or after a light application of a broom.

The writer was desirous of obtaining artificial conditions equal to dirty carpets, for the purpose of standardizing a cleaning test, and had at hand the results of a series of tests made by Mr. Stewart R. Miller at the Massachusetts Institute of Technology on a heavy-napped Brussels carpet filled with quicksand, which would pass a 50-mesh screen, at the rate of 5½ oz. per square yard, well rubbed in. Mr. Miller used Types A and C renovators. The writer duplicated Mr. Miller's tests on a long-napped Axminster carpet, using a Type F renovator. In duplicating these tests the author was assisted by Mr. E. L. Wilson, a graduate of the Institute, who

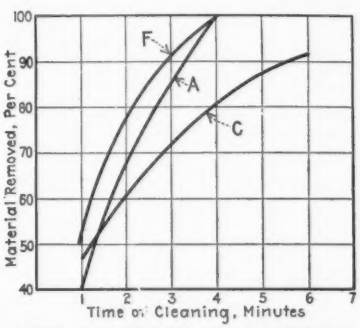


FIG. 1—TESTS OF RENOVATORS CLEANING DIRTY CARPETS.

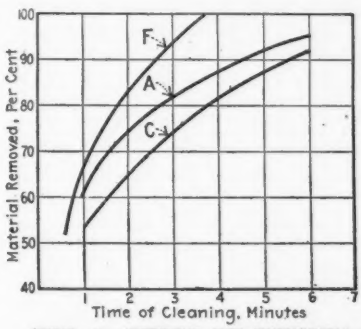


FIG. 2—TESTS OF RENOVATORS CLEANING CARPETS FILLED WITH 5½ OZ. OF SAND PER SQUARE YARD.

was familiar with the methods used by Mr. Miller and, with his assistance, the conditions of Mr. Miller's test were almost exactly duplicated. The results of Mr. Miller's and the author's tests are given in the table below:

TABLE 2—TESTS ON CARPETS FILLED WITH QUICKSAND.

Type of renovator	A	C	F
Vacuum at renovator, in	4½	4	3½
Air, cu. ft. per min	33	50	66
Material removed, per cent. of total:			
1 min.	60	53	66
2 min.	75	65	83
3 min.	82	74	94
4 min.	87	82	100
5 min.	92	87	..
6 min.	95	92	..

The results of these tests are shown graphically in Fig. 2. This test shows little change in the efficiency of renovators Types C and F, but shows a marked change in the characteristic of Type A renovator, it having fallen off in efficiency until it is nearly as low as that of Type C.

This change in the characteristic of Type A renovator is due either to the greater quantity of material to be moved, which, with the small quantity of air passing causing slower cleaning, while the large quantity of air passing Type F renovator is able to handle the increased quantity of material with equal speed to that of handling the smaller quantity in the former test, or to the longer nap of the carpet used, making the removal of the material more difficult. The writer is inclined to consider the change to be due partly to both, but largely to the latter of the above reasons, as it will be noted that the efficiency falls off more rapidly during the latter portion of the test when the quantity of material is smallest and to that the efficiency of Type C renovator, with its larger quantity of air, has also fallen off in efficiency which cannot be caused by the former of the above reasons.

In order to further investigate this phenomenon a series of tests was made, using a glue-sized back short-napped Brussels carpet filled with as much sand as could be worked entirely out of sight in same, which amounted to approximately 1 oz. per square yard. This carpet was cleaned with the three types of renovators with the results tabulated below:

TABLE 3—TEST ON BRUSSELS CARPET FILLED WITH SAND.

Type of renovator.....	A		C			F
Vacuum at renovator, in....	2	4½	1	2½	4	3½
Air, cu. ft. per min.....	22	33	30	43	50	66
Material removed, per cent. of total:						
1 min.	48	54	45	48	50	78
2 min.	70	87	60	63	65	93
3 min.	91	100	73	75	77	100
4 min.	100	..	76	81	88	..
5 min.	..	..	..	88	97	..
6 min.	..	..	..	92	100	..

The results of the tests, at the higher vacua are presented graphically in Fig. 3, which show that the three types of renovators have returned to the same relative efficiencies obtained when cleaning dirty carpets, but that all show a somewhat higher efficiency, which is due to the smaller quantity of material and to the difficulty in working the sand into the short-napped carpet.

The author recently received the results of a test made by Mr. C. C. Ladd of the Hydro Vacuum Cleaner Company, Buffalo, N. Y., made with a Type A renovator with 2 in. of vacuum at the renovator, 2½ oz. of sand per square yard of carpet, quality of carpet unknown. A comparison of the results of this test with one made by the author with 1 oz. of sand per square yard, 2 in. of vacuum at the renovator is shown in Fig. 4, and further shows the tendency of this type of renovator to fall off in efficiency when larger quantities of material per yard are encountered.

As the quality of the carpet and the degree with which the sand was worked into the carpet in Mr. Ladd's test are not

known, the above comparison cannot be closely made and is given here only to further show this characteristic of the Type A renovator.

In order that the relative efficiency of the various types of renovators as dust removers may be more readily seen, the cubic feet of air required to remove 1 oz. of dust by the different renovators under the different conditions in the foregoing tests has been tabulated below:

TABLE 4—AIR REQUIRED TO CLEAN DIRTY CARPET.

Type of renovator.....	A		C			F
Vacuum at renovator, in.....	2	4½	1	2½	4	3½
Cu. ft. air per oz. dust.....	7.5	8.9	24	25.8	25	36
Removing sand from carpet filled with 5½ oz. per sq. yd.:						
Cu. ft. air per oz. dust.....	..	10.7	..	..	16	9.2
Removing sand from carpet filled with 1 oz. per sq. yd.:						
Cu. ft. air per oz. dust.....	15.3	16.5	..	50	44.5	24

This shows that Type A renovator is the most efficient dust remover except in the case of a carpet filled with 5½ oz. of

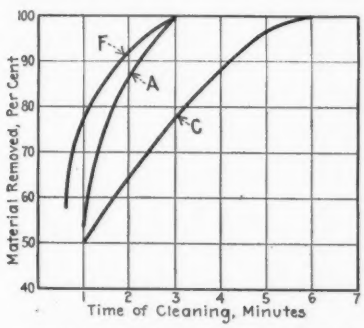


FIG. 3—TESTS OF RENOVATORS CLEANING CARPETS FILLED WITH 1 OZ. OF SAND PER SQUARE YARD.

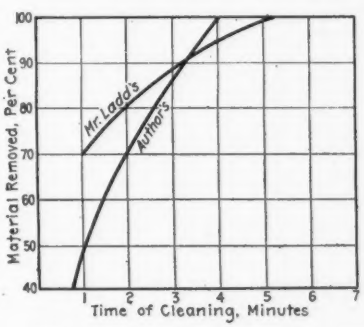


FIG. 4—COMPARISON OF TESTS BY WRITER AND BY A. A. LADD.

sand per yard where Type F renovator is slightly more efficient; also Type F renovator makes the poorest showing in cleaning dirty carpets.

As the speed with which cleaning can be done should also be considered as well as the efficiency, the rate of cleaning in ounces of dust removed per minute by each of the renovators under the different conditions of the above tests has been tabulated for easy comparison and is given below:

TABLE 5—RATE OF CLEANING AS SHOWN BY TESTS.

Type of renovator.....	A		C			F
Vacuum at renovator, in.....	2	4½	1	2½	4	3½
Cleaning dirty carpets:						
Dust removed, oz. per min...	2.2	3.0	1.25	1.66	2.0	2.0
Removing sand from carpet filled with 5½ oz. per sq. yd.:						
Dust removed, oz. per min...	..	3.0	..	..	2.86	7.25
Removing sand from carpet filled with 1 oz. per sq. yd.:						
Dust removed, oz. per min...	1.5	2.0	..	0.88	1.12	2.75

This table shows that Type F renovator is a much faster cleaner than either of the other types when operating with a large quantity of material and on heavy-napped carpets, but

shows very little difference in the speed of cleaning with Types A or F in all other cases, and that Type C renovator is a much slower cleaner than either of the others, especially when the quantity of material to be removed is small.

COMPARATIVE TESTS OF RENOVATORS SHOULD BE MADE ON SAME MAKE AND QUALITY OF CARPETS.

Shortly after making the above described tests, the author had occasion to make somewhat similar tests in an attempt to try out a proposed carpet cleaning test intended to serve as a standard for use in specifications for vacuum cleaning systems. When a Wilton velvet carpet was used it was found that neither Types A nor C renovators could fulfill the test requirements which were within the results obtained in the tests already described. Unfortunately a Type F renovator was not available at that time, but the author is of the opinion that this type of renovator would have fulfilled the specification requirements.

The test was then repeated, using a Brussells carpet and the requirements of the specifications were easily met. This discovery led to an examination into the action of various makes of carpet under the same test conditions and, from the result of the tests, the writer came to the conclusion that in a carpet cleaning test, which is to be at all comparative of the efficiency of the type of renovator used, all renovators must be tested on the same make and quality of carpet. Fortunately, the former tests tabulated in this paper were all made on carpets practically identical in make and quality in every case where comparison of the action of the various types of renovators was made.

CLEANING TEST NOT SUFFICIENT.

The use of a cleaning test as a requirement to be met by a vacuum cleaning system in order to be acceptable was at once abandoned by the writer and is not recommended for use in any case, except where the various renovators offered can be tested on the same carpet and under the same conditions. The value of the cleaning system is dependent on many other requirements not to be brought out by such a test.

Referring to the tests of renovators here described it will be seen that in order to obtain good cleaning results a considerable degree of vacuum within the renovator is necessary. The author considers that for best results the vacuum should be not less than 3 in. and to obtain fair results it should not be less than 2 in., while to permit easy operation and prevent undue wear on the carpets it should not be higher than 4 or 5 in.

CONDITIONS DETERMINING CHOICE OF RENOVATORS.

Before deciding which type of renovator will be the most economical to use in any case the character of the cleaning to be done must be considered. In nearly every case there is likely to be, in addition to the dust, larger particles, such as matches, cigar and cigarette stumps, small pieces of paper and other like articles which have to be removed, none of

which can be picked up by Type A renovator, and, in case of its use, must be picked up by other means. The greater the quantity of such articles, the more important that the renovator be capable of picking up same. The quality of the carpets, the quantity of dust they are likely to contain, the area to be cleaned, and the time available for cleaning must also be considered.

In small and moderate-sized residences the carpets are likely to be of the short-napped variety with either sized or unsized backs, and as they are not subject to large numbers of persons walking over them, they are not likely to contain large quantities of dust. Such dust as they do contain is not likely to be deeply ground into same. The presence of matches or cigar stumps on the floor is not to be expected, and the writer considers that Type A renovator will be the most economical to use for this class of work. For residence work 20 cu. ft. of free air per renovator per minute and a vacuum of 2 in. at the renovator is considered sufficient for fairly good work. This condition can be obtained with a vacuum producer and piping system of small cost to install and to operate.

In cases of large residences of the more expensive class, carpets of the long-napped variety are likely to be encountered. also, large gatherings of guests at receptions and the like will undoubtedly bring in much larger quantities of dust than we find in the smaller residences. For this class of work the Type F renovator is recommended. This will require the installation of a larger exhauster and piping system, and a greater expenditure for installation and operation, but will be more in keeping with the proportions and furnishings of a residence of this character.

In the case of office buildings, schools, stores, and other buildings which are devoted to public use, much more small litter, such as matches and cigar stumps, will have to be removed. Also, large quantities of dirt will be brought in on the feet of the many daily visitors. The removal of this litter and dirt must be done after the regular working hours; therefore it must be done as quickly as possible. As Type F renovator will pick up this litter and is the most rapid cleaner where large quantities of dirt are encountered, its adaption for use in buildings of this character is recommended.

This concludes Mr. Cooley's present series of articles on Vacuum Cleaning. The matter already published, together with a quantity of additional data, covering the history of mechanical cleaning, the proper proportions and arrangement of piping systems, requirements of various classes of buildings, various forms of vacuum producers, rules for designing systems, tests of complete installations, etc., copiously illustrated, will shortly be published in book form by the Heating and Ventilating Magazine Company, announcement of which will be made in due course.

Improved Air Conditions in a Boston Residence*

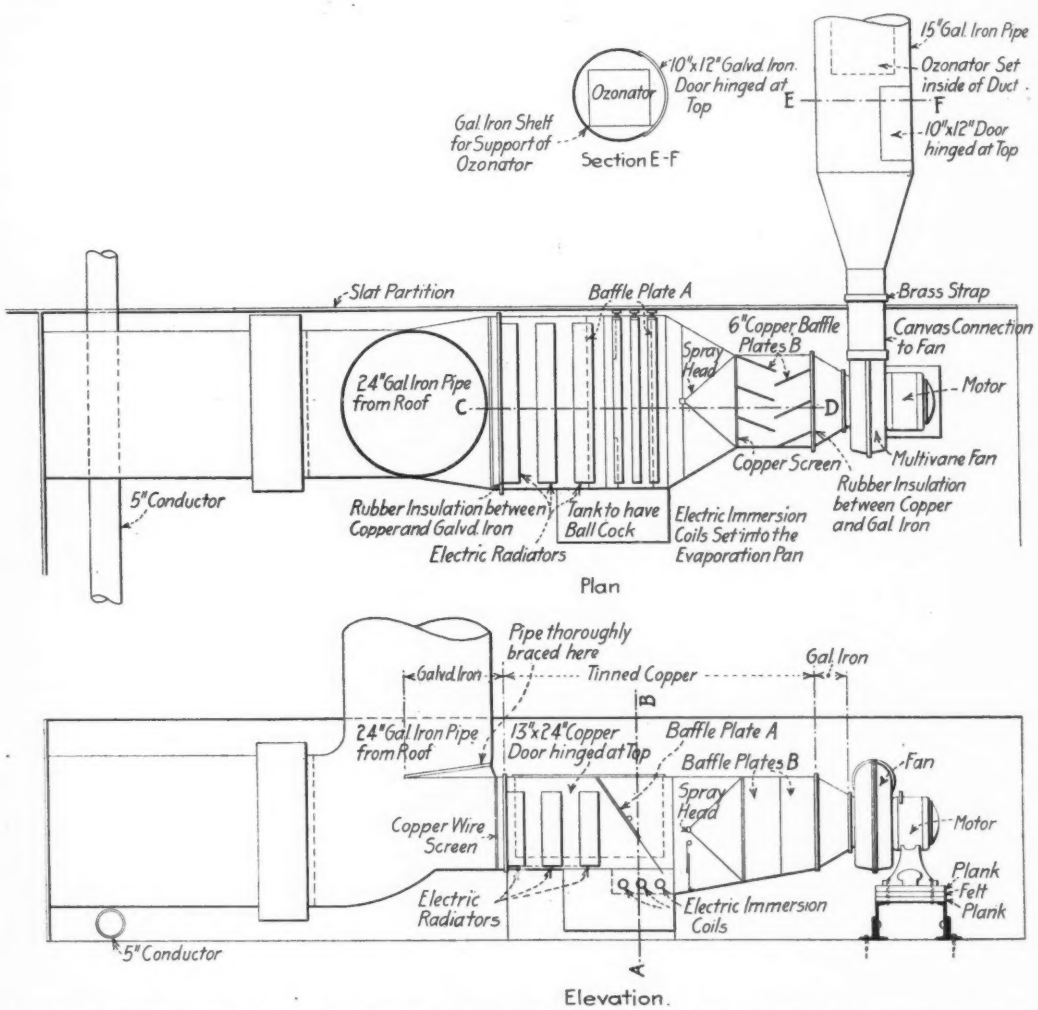
By Frank Irving Cooper.

Recently at the suggestion of physicians we have designed several plants for conditioning the atmosphere in dwelling houses and perhaps one of the most novel is the plant for Mr. Albert C. Burrage in his Boston residence on Commonwealth Avenue. This plant, although completed recently, seems so successful that a description of it should be of interest. It was desired to better the air conditions of certain rooms in this residence, and this meant introducing a fixed number of cubic feet of air, which should be cleaned, warmed, humidified, and should contain an added amount of ozone.

These conditions under ordinary circumstances would be comparatively easy to accomplish, but in this case the plant had to be installed in the space between the top story and the roof of the house, a working space of only 3 ft. in height; was to be controlled from a room three stories below, and the only means to the desired end were electricity and cold water under pressure.

Under usual conditions of cost the use of electricity would have been pro-

*Read at the annual meeting of the American Society of Heating and Ventilating Engineers, New York, January 21-23, 1913.



PLAN, ELEVATION AND DETAILS OF THE ELECTRIC AIR HEATING AND CONDITIONING APPARATUS.

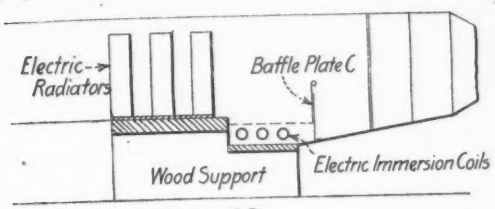
hibitive; the Edison Company of Boston, however, furnish current for power and heating purposes at one-fifth the cost of current for lighting. The Simplex Electric Heating Company, of Cambridge, built for us a special electric radiator in three units; the radiator was guaranteed to dissipate enough B. T. U. to heat 200 cu ft. of air per minute from zero to 70° F.

The number of cubic feet of air is controlled by a multivane, variable speed electric fan; the air is drawn from above the roof through a hood screened to prevent the admission of paper or leaves; there is also a fine screen near the radiators to remove smaller floating particles; the air then passes through the electric radiators, then through a water bath in the humidifying chamber, where vapor created to give the desired amount of moisture content in the conditioned rooms below; dust particles are entirely removed by the water bath, which can be renewed as often as desired.

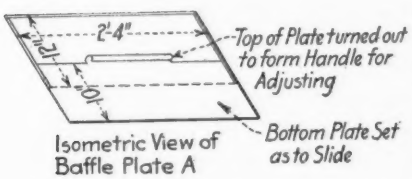
There is an atomizing spray for washing and cooling the air; large particles of water floating in the air current are removed by inserting copper wire screens of a special Dutch weave, which entirely clears the air before it passes through the fan. Beyond the fan in the main duct is placed an ozonair apparatus, which gives an additional quantity of ozone in amount desired.

The control of the electric radiators and the regulation of the evaporating coils is made by the Powers system, which automatically throws in or pulls out the proper electric switch as occasion requires. An air pressure of 15 lbs. per square inch is required to operate the switches. In this case we installed a water-driven compressor of the Powers make.

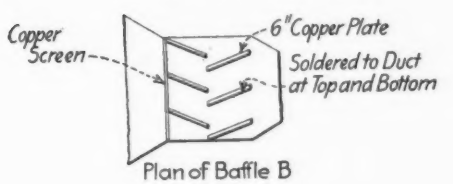
The main electric heater was designed by Mr. Hewett, of the Simplex company. It is made up in three sections, similar to the different units of a steam fan system of heating, each unit being separately controlled; but where a diaphragm valve is used on a steam plant here automatic switches are employed to make or break the electric connection which completes the circuit for supplying current to the different heating sections.



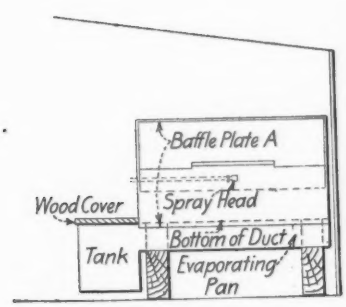
Section C-D



Isometric View of Baffle Plate A



Plan of Baffle B



Section A-B

DETAILS OF ELECTRIC HEATING AND CONDITIONING APPARATUS FOR BOSTON RESIDENCE.

CONSTRUCTION OF ELECTRIC HEATER.

The electric heater was designed to heat 200 cubic feet of air per minute from zero to 70° F. It consists of wire coils made up in the shape of a close spring ½ in. diameter and 14 ft. long. In the center of the spring is a stout asbestos cord. The spring is stretched out slightly and fastened to each end of the cord, thus keeping the convolutions of the cord separate. The spring was then looped over porcelain insulators mounted on an iron skeleton. Winding the coils in this way and using metal of low resistivity permitted a

large number of coils to be used, thus obtaining a large radiating area on the surface of the wire, which means that they would dissipate their heat and operate at low temperature, thus reducing oxidation to a minimum.

There were three sections, each consisting of 4 coils, as described, connected in multiple. Each section was separate from the other electrically and was of 2 K. W. capacity on 220 volts. All three sections were, however, mounted on a single strap iron frame and covered with an expanded metal guard. Insulation between element and guard was tested to 1,000 volts. The complete heater was designed to go in a space 28 in. long, 12 in. high, 16 in. wide. The heater has given entire satisfaction.

The cold air enters from the roof through a galvanized iron duct. In traveling to the first section of the heater it passes over a cold air, expansion type, duct thermostat, which is set for 40°. In mild weather, or at such times as the incoming air is above 40° in temperature, the first or outside section of the heater is automatically cut off.

The second and third sections of the heater are controlled by one graduated acting thermostat placed in the apartment supplied by air from this plant. It is located at the fan outlet, where incoming air passes freely over it, thereby allowing close regulation. This thermostat is the usual one employed by the Powers company for graduated damper work. Through its capability to graduate air pressure delivered to the second and third diaphragm motors, which are supplied with differential springs, a range of 2° is maintained by the use of one instrument.

The diaphragm motor controlling the second section of the heater is supplied with a pair of springs which are considerably weaker than those on the third motor, so that it takes less pressure to throw the second switch than it does the third one, the difference being enough to allow two degrees variation between the opening and closing of the two sections. The graduated thermostat is adjustable over a range of 20°—from 60° to 80°—and can be set for any temperature between these points by the use of a detachable key which is used to turn a marked dial over a graduated scale plainly shown on the cover of the instrument.

HUMIDIFYING DEVICE.

As explained above, the moisture is admitted to the air which has passed through the main heater. This is accomplished by three electric immersion coils placed in the bottom of an evaporating pan. These coils are kept covered with water automatically; they were designed by Mr. Hewett and are of the type such as are used in electrically heated steam boilers and large capacity water heaters. They consist primarily of a wire wound in spring form about as described in the air heater; in this case, however, a notched piece of mica is put in between each convolution. This is put in in such a way that does not permit it to fall out. The convolutions are therefore insulated from each other, and, as the mica extends beyond the periphery of the coil, it insulates the heating element from the tube in which the element is placed. The mica dividers each have a hole in the center, which permits a 3-16-in. rod to be pushed down the center of the coil, making it a straight rigid unit. Terminal blocks are attached at each end; the central rod forms the electrical return, thus permitting the heater to have its supply terminals at one end.

This unit was slipped into a brass tube, 1¼-in. outside diameter, No. 16 gauge, which had one end sealed and the other provided with a flange and threaded for a nut, which permitted the tube to be locked into the wall of the vessel, resting one end on the bottom. The joint was made tight by a gasket.

There are three heaters, each to evaporate about 4 lbs. of water per hour; each heater was of 1,100 watts, 220 volts, single heat, and was 27 in. long. The wire used in the water heater was altogether different from that used in the air heater. The number of heat units dissipated per unit area on the water heater is large and the element within the tube runs very hot. The wire is a nickel chromium alloy which will stand very high temperature without oxidation. Most forms of insulation

would break down under such a condition, but the large number of mica washers which stand edgewise to support the coil easily stand up under the work. The current of this heating coil is automatically regulated by a Powers hygrostat placed in the living apartments on the same panel with the thermostat which controls the temperature.

It was impossible to use lengths of galvanized iron pipe, as is the custom on automatic control work, so flexible armored lead tubing was used to supply thermostats and hygrostats with air pressure and also to make connections between these instruments and the four diaphragm motors used. The tubing was extended from the air storage tank, along the under side of the roof, to the flue that leads to the room—from where it was dropped into the flue and connections made to the controlling instruments by running the lines on the inside of a cabinet—thus exposing none of it in the rooms. From the thermostats and hygrostats return lines were carried back the same way to the different diaphragm motors. Very little cutting and no patching was necessary to install this system, which is working to the satisfaction to all concerned.

The atmosphere is pleasant and restful, and the effect of the conditioned air is already distinctly beneficial. While it is too early to declare with positiveness that the proper adustment of heat, moisture and ozone has been reached, we have all of these under control and shall be able to meet any particular requirement of the attending physician.

Engineers in Civic Affairs

BY REGINALD PELHAM BOLTON

The small share taken by the members of the engineering profession in connection with public affairs, has attracted the attention of the American Institute of Consulting Engineers, which has discussed the subject at several of its recent meetings. Particular attention has been drawn to the fact that the important controlling bodies, such as the public service commissions, have no engineers among their number, although they are dealing with problems of a technical character, necessitating technical knowledge for full consideration.

This condition is so noticeable in connection with many other departments of civic work, that the members of the engineering profession would do well to give the subject consideration.

As one who has taken an active part in local civic problems, the writer is able to state, from his experience, that an engineer is better equipped to aid in dealing with such subjects, from the public point of view, than a member of any other profession. It is safe to say that at least one-half of a city's problems are more or less intimately connected with technical matters. In all such problems, the training of an engineer will enable him to aid his fellow-citizens in securing needed improvements, in investigating municipal and governmental methods, and in analyzing figures. The latter is one of the most difficult problems in civic work, as a large majority of our citizens, including those who are most active and interested in such problems, are unacquainted with the meaning and effect of figures and are often entirely unable to determine their bearing upon a municipal or governmental problem.

All these considerations indicate that the engineer can do good and effective work by taking a share in betterment and uplift problems, and there is no reason, other than the modesty and reticence of the members of the profession, why they should not form the leading element in these good works.

As an instance that is directly of interest to the members of the profession of heating and ventilating, the great subject of the ventiliation of New York City's public schools is now being dealt with by the Board of Education composed, as Mr. John Martin has recently stated, entirely of untechnical laymen, dependent upon information derived from some one engineer engaged for the purpose, or, as is more generally the case, dispensing entirely with any technical assistance. Why should a board charged with the important duty of caring for the

health of the children of a city, be without a single technical member? This has simply come about because engineers have not drawn the attention of the appointing authorities to the need for such an appointment, and because these appointing authorities are in ninety-nine cases out of one hundred, members of the legal profession, whose knowledge and opinion of the engineering profession is usually narrow and restricted.

Our technical societies are not free from blame in this connection; one of the leading engineering societies adopted the attitude some years ago of standing aloof from all public affairs and refusing even to present a list of eligible and experienced members for appointment upon public duties.

The best course to remedy the existing condition is for all engineers to unite in demanding recognition, but while that process is going on, to get out into public affairs and take an active part in the work of voluntary associations, on committees and on the public platform.

Air Washers and Dust Removal

APPLICATION OF THE AIR WASHER PARTICULARLY TO THE RECLAMATION OF VALUABLE DUST OR THE ABATEMENT OF DUST NUISANCES IN CONNECTION WITH EXHAUST SYSTEMS.

Among the many problems which confront manufacturing industries in thickly populated communities, that of dust removal is frequently very serious. This applies to industries where pneumatic conveying of light material is employed or in whose processes large quantities of dust are formed which necessitate continuous removal by fan exhaust systems. This dust is valuable in some cases and purely waste in others.

Regardless of its value, the scattering of it over the neighborhood often becomes an annoyance, giving rise to injunctions, threats of damage suits, etc. Complete shutting down of a plant with its attendant expense is not infrequent, pending the installation of apparatus to abate the nuisance. In such emergencies ineffective make-shifts and costly experiments are the rule. The result is, perhaps, a partial suppression of the annoyance which may temporarily relieve the situation; the same condition often has to be met again and all previous expenditure of time and money is wasted.

As its almost universal application indicates, the centrifugal type of dust collector has proven to be the most practical device, to date, for the separation of solid matter from air. The efficiency of a dust separator varies widely, depending chiefly on the character of the material, other things being equal. An important fact is that the percentage of material escaping consists of the finer particles which are more of a nuisance than the coarser dust which would not be carried so far by the prevailing winds.

The recent issuing of patents brought to light a system which affords a means of overcoming such difficulties through

ARRANGEMENT OF AIR WASHER IN CONNECTION WITH DUST RECLAMATION PLANT.

CLOUD OF DUST ENSUING FROM SEPARATOR IN ORDINARY EXHAUST SYSTEM.

the combination of a dust collector and an air washer. That it has not been more generally known is due to the fact that exploitation was deemed inadvisable until the pioneer systems had proven practical and continuously efficient. The success of the several systems now in operation for reclamation service has far exceeded the expectations of both the owners and manufacturers.

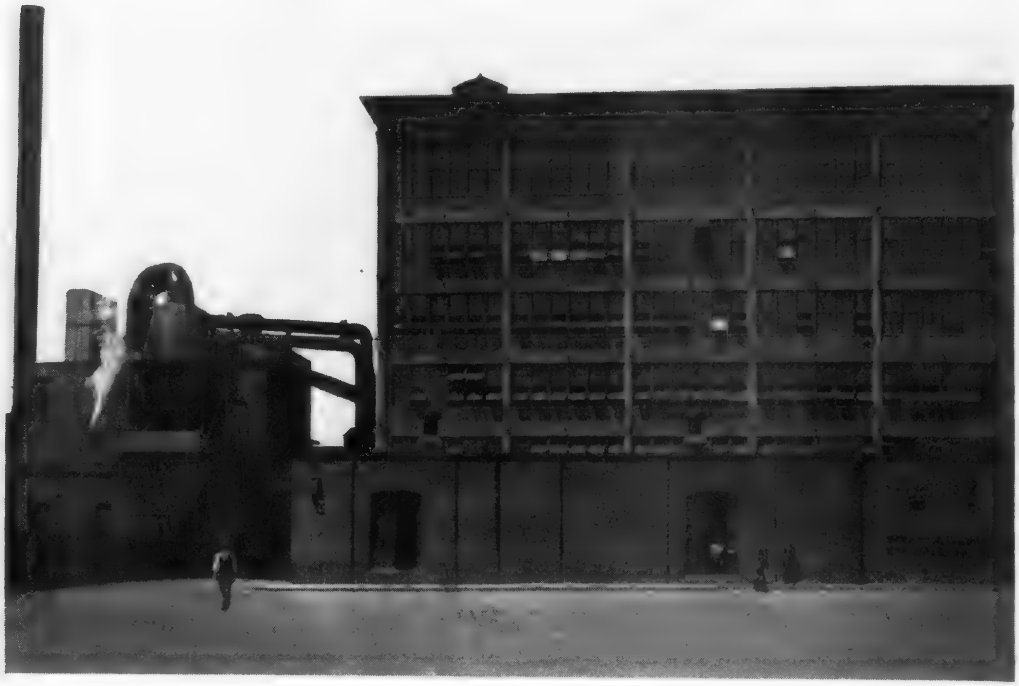
In one large and well-known plant of an Eastern manufacturing company three successive systems were installed. The first was installed to abate a nuisance, but it was soon found that the material removed was suitable for reworking. The owners state that the actual saving the first year exceeded the cost of the entire installation. The second apparatus was installed to remove sawdust; it presented some rather perplexing problems because of the behavior of the material when wet, and its large quantity. About 50 cu. ft. of sawdust, in the form of an almost impalpable powder, is removed every working day. The third apparatus is similar to the first and performs the same kind of service.

The air washer becomes a practical device for this work chiefly when used in conjunction with a dust collector, since the former is not able to handle large quantities of material with the same facilities as the latter.

An air washer designed for this service will remove from 90 to 95% of the dust escaping from a dust collector. Assuming that a collector has an efficiency of only 50% for an extremely difficult material and that the air washer will remove but 90% of that escaping, the plant efficiency will be about 95%; with less difficult materials to handle the efficiency becomes practically 100%. Under any conditions, then, the efficiency will be such that it will in effect abate any dust nuisance.

Briefly, the scheme involves a dust collector the air discharge outlet of which is connected to a specially designed air washer. The design of such an air washer is a matter dependent in many respects on the character of the

AIR WASHER AS INSTALLED IN CONNECTION WITH EXHAUST SYSTEM AND SEPARATOR.



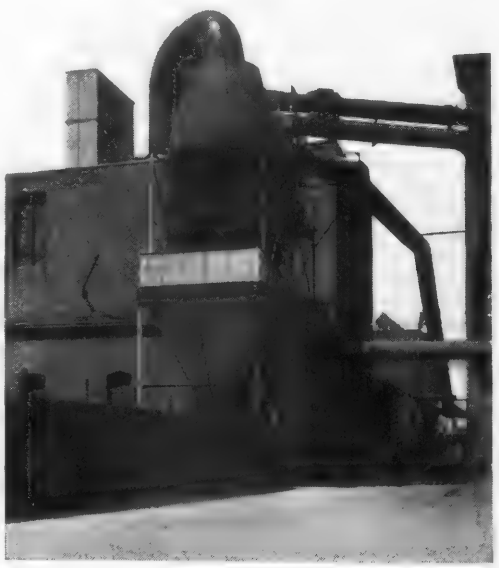
REMOVAL PLANT, USING AIR WASHER IN CONNECTION WITH EXHAUST SYSTEM.

material to be handled and upon local conditions. Naturally there are some broad principles which form the basis of design, but beyond this, individual treatment is required in each case.

Preliminary to the designing of such a system it is necessary to conduct extensive tests in an experimental apparatus with the material to be removed. The behavior of the dust under various forms of spray, its affinity for various materials, etc., are noted. The arrangement of nozzles and spray heads, form of eliminator, disposition of additional washing surface in some cases and many other considerations affect the final lay-out.

Back pressure upon the dust collector lowers its efficiency greatly, with corresponding increase of work for the air washer. The equipment in connection with the dust collector must, therefore, be taken into consideration, since excessive back pressure might create serious disturbances.

It is obvious that in work of this character spray devices must be used which do not readily clog. They must be simple, since unskilled labor is usu-



NEARER VIEW OF SAWDUST REMOVAL PLANT, SHOWING CONNECTIONS FROM SEPARATORS TO AIR WASHER.

ally depended upon for their care. Refinements in strainer design have been introduced which permit recirculation of the spray water without danger of clogging and with resultant economy of water.

Special tanks are provided and arranged so that the material precipitated can be readily removed while the plant is in operation.

The space required is comparatively small, which further adapts the system to industries in congested districts.

The illustrations show the general arrangement of apparatus, connection from the dust collector to the air washer and the discharge to the atmosphere. The general form of the air washer and special tank are also shown. The strainer and fresh water valve are in the side extension of the tank where they are removed from the settling material and at the same time made accessible. The material is removed from the extension at the rear of the apparatus.

Systems have been in service for a sufficient length of time to warrant the attention of engineers. It is considerably beyond the experimental stage and has been found to be a valuable adjunct to the general line of apparatus employed in exhaust systems. The systems here described and illustrated has been developed by Warren Webster & Co., Camden, N. J., and this firm has made a specialty of this work.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

Nineteenth Annual Meeting, New York, Jan. 21-23, 1913

Notable results in the way of developing model laws for the heating and ventilation of public buildings and especially of moving picture shows were achieved at the annual meeting of The American Society of Heating and Ventilating Engineers, held at the Engineering Societies Building, New York, January 21-23. The report, for instance, of the committee on legislation for compulsory ventilation contained a proposed specimen ventilation law covering buildings used for school purposes, auditoriums, hospitals or sanitariums, theatres, moving picture shows and other meeting places. A separate report from a committee on proposed standards for ventilation legislation for motion picture theatres specified minimum ventilation standards for such places, taking up also the matter of the proper floor area and cubic space per occupant.

While the discussion of these reports brought out suggestions that will probably result in minor changes in the requirements as proposed, the main features of the reports constitute a basis for a nation-wide campaign for bettering the conditions in the class of buildings enumerated.

As soon as the model laws are in proper shape it is the intention of the society to circulate them widely among owners and others for their information and guidance. In this way the society will have achieved one of its principal objects in making its transactions of lasting service to the public at large as well as to the heating profession.

Another movement for the benefit of the profession itself was brought out in the report of the committee on heating guarantees. As a result of its deilberations, this committee recommended that the designer of apparatus should be considered responsible for the results to be obtained by its use, provided it is installed and operated as designed and intended; and that the contractor should only be held responsible for the installation of the apparatus in the time agreed, with materials specified, in exact conformity with the design and specification, and such materials and labor as he

may furnish in placing the apparatus, and that any guarantee which the contractor may be called upon to give, covering the installation, completion and materials and labor furnished, should not extend for a longer period than one year from the time of completion and permanent operation of the apparatus.

The question of what guarantee or assurance, if any, the designer should give the owner is one that would depend somewhat on existing conditions. If it were in an old building and the designer was thoroughly familiar with its construction, exposure and tightness he would reasonably be expected to guarantee the successful operation of his work. If, on the other hand, he were called upon to design apparatus for a building not yet constructed he could reasonably assume that the building would be well constructed, and any defect in the construction of the building which interfered with the successful operation of the apparatus designed by him for a well-constructed building should be chargeable to the architect, owner or building contractor, and not against the designing engineer.

The report of the committee on schoolroom ventilation was noteworthy in detailing the experiments that were conducted in the Oliver Wendell Holmes School in Boston, where special humidifying apparatus was installed for a typical class room, and the results compared with the conditions in a similar class room equipped with the usual mechanical system, without an air washer. This report was accompanied by numerous drawings of the apparatus, together with colored charts presenting the results in graphic form. The tests already conducted demonstrated the desirability of the humidifying equipment.

Important papers were presented on "Downward Ventilation in a Rockford, Ill., Schoolhouse," by Clinton E. Beery, Rockford, Ill.; "Air Conditioning and Electric Heating in a Residence," by Frank Irving Cooper, Boston; "The Design of Indirect Heating Systems with Respect to Maximum Economy and Efficiency," by Frank L. Busey and Willis H. Carrier, Buffalo, N. Y.; "Ozone and Its Applications," by Dr. M. W. Franklin, Schenectady, N. Y.; and "Analysis of a Combination Heating System for a Residence," by Frank K. Chew, New York.

Afternoon Session, January 21.

The opening session was called to order by Acting President John F. Hale, Tuesday afternoon, January 21. Following the routine business, the chairman read the address of President John R. Allen, who is still in Turkey, where he went two years ago to establish an engineering school in connection with Roberts College at Constantinople. Prof. Allen wrote that his address was written within earshot of the Bulgarian guns during the attack of the allies on the lines near the city.

The president's address was on the subject of "Developments and Present Problems in Heating and Ventilation," in the course of which he stated:

"In many of the great cathedrals of Europe no heating system is provided, and these buildings are never uncomfortable, owing to the heat stored in the building structure during the summer months, and returned to the air during the colder months. A good example of the use of the heat stored in a building comes from Germany.

"Recently a state dinner was to be given in a castle which had no heating system. The engineers were asked to heat the building for the dinner, but it was specified that no portion of the heating system was to be visible in the room. The result was accomplished by means of stored heat. For a number of days previous to the dinner, the floor of the dining-room was covered with steam pipes, and these pipes were kept hot by means of a temporary boiler.

"The day before the dinner all the pipes were removed and the stored heat in the walls maintained the room in a perfectly comfortable condition for a number of days, although the outside temperature was well below the freezing point.

"None of our rules of heating takes these conditions into consideration. It is quite possible that it would be better in buildings of heavy construction to base the necessary amount of heat to be supplied not upon the minimum external temperature, but rather upon the average external temperature for a period of

ANNUAL DINNER OF THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, NEW YORK, JANUARY 22, 1913.

time. Most heating engineers allow a margin of safety which covers their ignorance of the conditions entering into the problem."

Further on, in discussing the need of cooperation of the heating engineers with other bodies, especially members of the medical profession and physiologists, he urged the establishment of some such body as a national ventilation commission, adding that "it would be perfectly proper for our society to endeavor to interest persons or institutions of large means in establishing an experimental laboratory in which matters pertaining to heating and ventilation and allied subjects could be investigated."

The report of Secretary W. W. Macon showed that two volumes of the proceedings had been issued during the past year. The total receipts for the year were $4,717.40, which, with the balance of $1,397.41 from the preceding year, made a total of $6,114.81. The total disbursements for the year were $5,073.19, leaving a balance on hand of $1,041.62. Treasurer James A. Donnelly's report gave details of the receipts and disbursements, and was supplemented with suggestions for improving the society's accounting methods.

It was brought out in the report of the board of governors, which was read by Secretary Macon, that a movement is under way to organize a chapter of the society in Philadelphia. The board expressed itself as wishing to encourage the formation of additional chapters and testified to the advantages derived by local groups of heating engineers meeting periodically and exchanging information more or less informally.

The board also reported a notable gift of books to the society made by Dr. William Paul Gerhard, C. E. The set comprises 89 books and pamphlets on heating and ventilation in the English and German languages. These volumes have been installed in the society's library, where they may be consulted.

The present membership of the society was shown to be 425, composed of 382 members, 27 associate members and 3 honorary members. The net increase in membership during the year was 24. A list of deaths of members during the year contained the names of Warren S. Johnson (died Dec. 5, 1911); William C. Bryant (died April 6, 1912); Herbert A. Joslin (died October 3, 1912); Andrew Harvey (died October 9, 1912); and Newell P. Andrus (died January 13, 1913).

The board of governors' report concluded with a number of recommendations relating to the society's policy and routine.

COMMITTEE APPOINTMENTS

Tellers of election were appointed by the chairman, consisting of Frederick K. Davis, Edward K. Munroe and U. G. Scollay; also an auditing committee, consisting of Frank K. Chew, Walter S. Timmis and James H. Davis.

CHAPTER REPORTS

Samuel R. Lewis, of Chicago, reported for the Illinois Chapter, stating that the organization was in a flourishing condition and confident of increasing its membership 100% during the coming year. Joseph Graham, secretary of the New York Chapter, reported a membership of 74, the chapter being on a firm and successful basis. For the Massachusetts Chapter, J. W. H. Myrick reported, as its most important achievement, the preparation of a bill for the separate letting of heating and ventilating contracts on public work in Massachusetts. The movement, he reported, has already enlisted the support of heating contractors, plumbers and architects who are working with the chapter to secure the enactment of the measure.

REPORT ON COMPULSORY LEGISLATION

In addition to the proposed specimen ventilation law, which was submitted by the committee on legislation for compulsory legislation, and which was referred back to the committee with suggestions for amendment before being published, the report contained the following interesting comments on the developments during the year:

The chief difficulty in preparing such a work is the unsolved problem of "what constitutes good ventilation?" The old standards have been questioned and entirely discarded by many, but as yet no new ones are formulated to take their places. In this unsettled condition there should be a thorough discussion before the committee report can be said to represent the views of the society.

APPEARANCE OF RADICAL ARTICLES

Some technical articles appearing within the last year or two have made statements that are extremely radical, to say the least, when analyzed with calmness and good judgment. Many of these extremely partisan statements will later be found to be ill-advised, but the agitation proves conclusively that the subject is being studied more than ever before.

Prominent men of science are conscientiously giving time and energy to find a solution that may be generally adopted. All honor to such men. Great care should be exercised, however, not to become so sensational and vitriolic in public denunciation of existing conditions as to forfeit the applause of thinking men, as was true of an article entitled "The Vicious Quantitative Standard of Ventilation," which came out in one of our prominent engineering journals bearing a photograph of the author and a half-page cartoon, the latter more fitted to adorn the front page of the Police Gazette than to elaborate what was supposed to be a serious article for the betterment of mankind, by one who claims to be an engineer.

Again, it is unwise to make sweeping conclusions as to the permanent effects upon humankind from a few short tests of a few hours' duration, as for example the following, which is quoted verbatim from one of our American journals:

"These experiments prove conclusively that through the metabolic assimilation of man no gaseous excretions of a toxic character and capable of causing health-interfering effects observed in crowded rooms, are thrown into the atmosphere. On the other hand, all the experiments indubitably indicate that the cause of such interference with health is to be traced to the thermal conditions of the environment and to the heat accumulation conditioned by this environment."

Such a statement is justifiable only after years (instead of days) of careful investigation. No one will doubt that the experiments leading up to this conclusion showed improved temporary comfort and stimulating effect by certain degrees of air movement, temperature and humidity, but how about the permanent effect?

Suppose a number of persons were being experimented upon and some of these were unfortunate enough to be afflicted with diseased lungs or skin. Would the health of the other occupants be permanently affected if obliged to breathe this air indefinitely? Suppose we assume that all the persons were in good health when the experiment began, could they maintain this good health permanently in an atmosphere where the by-products of combustion are continually increasing and the health-giving qualities of the air are continually decreasing? Granting that CO_2 is not poisonous, how much of an increase of CO_2 may be permitted in the air that is to be used continuously?

Granting that we can exist without *temporary* discomfort in an atmosphere having much less than 21 per cent. oxygen, what will be the *permanent* effect?

These are some of the questions that need to be seriously considered before we can consistently disregard, as some have advised, that time-honored axiom, "pure outdoor air and plenty of it." This society stands for scientific progress, and every member will welcome a thorough discussion of this most important subject.

PROGRESS IN WORK

In addition to the efforts of your committee to formulate a typical law, the work in the field is not at a standstill. In at least two states there are hopes of obtaining compulsory ventilation laws. In Nebraska your representatives are working with a committee from the Nebraska State Medical Society and expect to submit a ventilation bill to the Legislature which is now in session. In Tennessee our member, Mr. Harwell Allen, reports that he hopes to be able to submit a bill to the Legislature of that state. We trust that both of these endeavors may be fruitful.

WORK IN CHICAGO

In Chicago, Dr. E. Vernon Hill has been appointed Chief Ventilation Inspector, with assurance of such assistance as will be necessary to see that the ventilation ordinances are carried into effect. This is certainly a step in the right direction. In addition, the Chicago Ventilation Commission has been reorganized with a few new members, including a member of the American Institute of Architects and a member of the Chicago

Architects' Business Association. This commission will hold meetings throughout the coming year every two weeks. We hope this commission will continue the investigations with the experimental room in the Chicago Normal School, and be able to report some conclusive results at the end of the year.

COMMITTEE ON STANDARDS

In connection with a proposed code for testing house heating boilers, E. A. May, chairman of this sub-committee, reported that a report could be expected at the next summer meeting of the society. The report on heating guarantees was read by Chairman W. M. Mackay, as already referred to. The committee was requested to prepare a standard form of contract for use in heating work and embodying the features brought out in the report. This action was taken after Prof. Kent had spoken of the necessity of an operating test of the heating apparatus.

COMMITTEE ON TESTS

For the committee on tests, Chairman L. C. Soule referred to some tests made at Buffalo to determine the efficiency of pipe coils and cast-iron radiation under fan blast conditions. The results, which, he stated, he would give in detailed form at the next summer meeting, showed that with equal frictional resistance, the same amounts of heat are given off with different types of coils and radiators.

James A. Donnelly, a member of the committee, told of the recent inspection trip of heating engineers to the boiler and radiator plant of the H. B. Smith Co., at Westfield, Mass., and to the Sheffield Scientific School at Yale University. He also reported, at a later session, the results of some tests on radiator steam traps made by Charles J. Jackson of Chicago at the Department of Steam Engineering, University of California, and proposed a standard method for testing radiator steam traps or vacuum valves (published in THE HEATING AND VENTILATING MAGAZINE for September, 1912).

Another feature of the report of the committee on tests was presented by Prof. L. A. Harding, a member of the committee, who told of the data obtained by the Armstrong Cork Co., of Pittsburgh, regarding heat losses from buildings. These data, said Prof. Harding, cover the results obtained in the course of many years' tests. They show, among other things, that no tests in this connection are of value unless the velocity of the air is given. Many of the German tests, he said, were run in still air.

Prof. Harding also described some tests made to determine the co-efficient of friction of air in ducts by entry to branch ducts which showed that the usual coefficients were somewhat high.

Appreciation of the unusually full report of the committee on tests was shown in a vote of thanks for the committee's efforts. It was also voted to recommend that each member of the committee on tests be authorized to appoint two additional members from his particular locality to facilitate the work of carrying on tests.

OTHER REPORTS

Edmund F. Capron, chairman of a committee appointed to confer with a similar committee of the National District Heating Association, on educational lines, stated that arrangements for a conference were being made.

The session closed with the election by ballot, of the following nominating committee for next year: Homer Addams, James H. Davis, E. K. Munroe, W. G. Snow and L. A. Soule.

Evening Session, January 21.

The report of the tellers, read by F. K. Davis, showed the following officers elected for the ensuing year:

PRESIDENT

John F. Hale, Camden, N. J.

VICE-PRESIDENTS

Albert B. Franklin, Boston, Mass.
Edmund F. Capron, Chicago, Ill.

TREASURER

James A. Donnelly, New York

MANAGERS

Frank T. Chapman, New York; Ralph Collamore, Detroit; D. D. Kimball, New York; W. W. Macon, New York; J. M. Stannard, Chicago; and Theodore Weinshank, Indianapolis. Additional members of the council are the two past presidents of the society, John F. Hale and Prof. John R. Allen.

In addition to the papers read at this session, Prof. Dr. G. B. Affleck of the

International Y. M. C. A. Training College, at Springfield, Mass., told of the experiments that were being conducted at that institution in connection with humidity and temperature.

This was followed by the reading of the report on schoolroom ventilation by Frank Irving Cooper, chairman. A supplementary report from Charles F. Eveleth, describing in detail the experiments conducted at the Oliver Wendell Holmes School in Boston together with the large charts already referred to were presented by H. W. Whitten, one of the members of this committee.

Morning Session, January 22.

Following the reading of a paper on "The Design of Indirect Heating Systems with Respect to Maximum Economy and Efficiency," by Frank L. Busey, an address was made by Dr. W. M. Franklin on "Ozone and Its Applications." Prof. Franklin spoke extemporaneously. He proved a forceful speaker and his presentation of the subject was heartily applauded. He advocated the use of ozone not as a substitute for ventilating systems, but as supplementary to such apparatus. Subsequently the meeting room was equipped with alternating current ozonators of the "household-utility" type, made by the General Electric Co., and those present were given the opportunity of seeing how the presence and odor of tobacco smoke were neutralized by these machines.

The report of the committee on ventilation of moving pictures was then presented by Frank T. Chapman, chairman. The discussion of this report which was carried over to the next day, included a number of suggestions that will modify the proposed requirements in some respects before it is ready for final acceptance. These will be made, it is expected, by the time of the society's mid-summer meeting.

Morning Session, January 23.

A topic on "establishing a standard practice of measuring air velocities at registers," brought by C. A. Haslett was the first item on the programme for Thursday morning and was discussed at length. In an effort to achieve definite action at the meeting, it was voted that a committee be appointed to suggest a specific recommendation for the consideration of the society. The chairman appointed on this committee C. A. Haslett, Philadelphia; J. I. Lyle, New York; and A. Edson Hall, Albany, N. Y. This committee reported at the afternoon session.

The committee proposed the following method of measuring air velocities at supply registers for adoption by the society:

1. The opening shall be divided into equal rectangular area, no side of which shall be over 10 in. long, excepting where this would require more than ten readings, in which case the opening shall be divided into twelve equal areas.
2. Readings are to be taken in every case at the center of every area.
3. Readings are to be one-half minute duration, the anomemeter being held at the register base or in the plane of the opening.
4. Where the diffusers are used, a total area is to be computed on the basis of the periphery of the diffuser.
5. The average of the readings are to be considered as the average velocity at the opening. Where negative velocities are found, they are to be deducted in arriving at the average velocity.
6. In computing volume, the net area of opening is to be taken, the volume to be considered as the product of the average velocity and the net area of the opening.

In the discussion of the report many points were brought out that will be incorporated in the committee's final recommendations.

This was followed by the reading of a paper on "Analysis of a Combination Heating System for a Residence," by Frank K. Chew.

Before the noon adjournment a resolution, presented by William C. Vrooman, was adopted advocating that in future certain days of the meeting be reserved for the discussion of specified topics.

Afternoon Session, January 23.

A letter from the American Society of Mechanical Engineers was read asking the cooperation of the society in extending the standard sizes for flanges and flanged fittings, in addition to the work already done under the name of the "1912 U. S. Standard." It was pointed out

that it was not contemplated that the present recently-adopted standards were to be altered in any way. It was voted that the society cooperate with the mechanical engineers, as suggested. The chairman stated that the personnel of the committee to act under the resolution would be announced later.

A discussion as to the possibility of holding the annual meeting in some other city than New York was favorably discussed and a motion was carried that there was no objection to hold the annual meeting outside of New York. The provision in the constitution designating New York as the meeting place may be fulfilled by having a short business session with adjournment to any point that may be designated for the professional sessions.

The meeting thereupon adjourned *sine die.*

The Annual Dinner.

A hundred members and guests of the society sat down to the annual dinner which was held Wednesday evening, January 22, at the Martinique. President-elect Hale acted as toastmaster. On his right sat Mrs. Florence Kelley, secretary of the National Consumers' League, while at his left was John Martin, of the New York City Board of Education, who acted recently as chairman of the committee appointed by Mayor Gaynor that investigated the heating and ventilating equipment of New York's public schools. During the dinner vocal and instrumental music was rendered by specially engaged musicians.

Following the toastmaster's introductory remarks, the first speaker of the evening, Mrs. Florence Kelley was introduced. Mrs. Kelley stated that the Consumers' League, of which she is secretary, was founded 20 years ago with the object of interesting its members in the conditions under which the goods they purchase are manufactured. She spoke of the improvements that had been effected in such cities as Pittsburg in the ventilation of candy factories where the air is now admitted through water and cotton batting. Similar applications elsewhere, she declared, would make factories better to work in than homes are to live in.

In connection with knife grinding she stated that in one case the quantity of steel particles that were given off into the air was so great that where children employed in this industry were in the habit of taking shower baths in a neighboring building, complaint was made that the baths were noticeably rusted.

Mrs. Kelley reproached the heating engineers for not giving more publicity to their work. "Some of our suggestions," she said, "are quite ridiculous, but it is because we do not know. Won't you please popularize ventilation? We need a more versatile knowledge on this subject than we now have. Won't you please help us to get a more educated staff of inspectors? There is hardly a man on the inspection staffs who has had any technical education. Inspection is a profession. It is useless to work out valuable systems if useless systems are to be approved by such inspectors."

The following speaker, John Martin, declared it was a proof of the society's broadmindedness to ask him to attend the dinner, because he was a doubting Thomas. "But," he added, "my views are not nearly as radical as yours." Mr. Martin declared that his work on he committee that investigated the schools made it as hot for the Board of Education as for the children in the school rooms.

He was astonished at the clashes of opinion he found, especially among the principals of the school. Moreover, the greatest dissatisfaction was expressed in regard to the buildings supposed to be the best heated and ventilated. "Then the doctors staggered us," he continued, "when they told how they were discarding such systems in the city hospitals and that the patients improved more quickly in the open air. They told us that some element of the air is changed or extracted as a result of the air's passage over heating coils and they compared such air to sterilized milk. Some of these doctors have fastened on argon as the vital element. So we got our heads pretty well muddled. Dr. Allen Richards of Boston said that 20% relative humidity was quite satisfactory while others put the figure at from 55% to 80%.

"We finally ruled that 68° F. should be the maximum indoor temperature, but we still found outrageously high temperatures in the schoolrooms. If it had really been cold this winter, we would have had a coal famine.

"In the Adirondacks the farmers keep their houses at over 80° and while the men do not suffer, due to the fact that they are outdoors much of the time, it is a well-known fact that the wives are sickly. They are indoors practically all of the time. The fact is, we have got accustomed in America to excessive indoor temperatures. Women like to wear light clothing in winter and, in schools, the teachers so dressed want the room hot. The heavily-dressed children have to suffer.

"More latitude is now given to principals. The teachers are not only permitted, but ordered to open the windows to cool off the

rooms. We believe that it is a fundamental requirement that heating and ventilating systems shall be capable of being operated at times with open windows.

"The healthy craze for fresh air is spreading. Sleeping porches are now the rage. Where bathrooms were formerly the principal features of a house, the sleeping quarters now take the front rank. While night air is dangerous in undrained countries, we have learned that it is not so in localities such as most of us live in.

"In the cities we are getting later and later in our habits. We spend most of our waking hours in closed quarters under artificial light. Therefore, our air supply is becoming of increasing importance.

"At the same time, it is probable that the Board of Education will give orders less lavishly for elaborate heating and ventilating equipment. We ask the doctors to make healthy conditions that, if obtained, would put them out of business. By the same token, we now ask ventilating engineers to devise systems of natural ventilation that shall put them out of business."

The Entertainment.

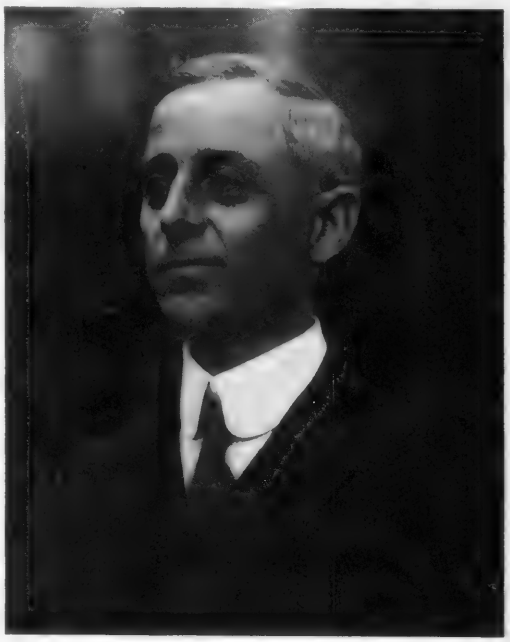
A programme of entertainment arranged for the ladies, included trips to the Metropolitan and Singer Towers, a visit to the immigrant station at Ellis Island and an automobile trip to the Metropolitan Museum of Art. On the day of the Ellis Island trip, a luncheon was tendered the ladies at the Waldorf-Astoria. The ladies also attended a matinee of "Milestones," while a Hippodrome party for all was arranged for the evening following the close of the meeting.

The following day visits were made by parties of men to the new Grand Central Station terminal, under the escort of F. K. Davis, and to the Washington Irving High School, at the invitation of the Board of Education. Here was seen an example of the latest practice followed by the engineering department of the Department of Education in this class of work.

Edwin A. Scott Appointed Secretary.

A meeting of the council of The American Society of Heating and Ventilating Engineers was held immediately following the adjournment of the society's annual meeting. At this meeting Edwin A. Scott was appointed secretary to succeed W. W. Macon, whose term of office expired with the outgoing administration. Mr. Macon's professional duties had assumed such proportions that he found it impossible to continue further as secretary.

Mr. Scott, who is the managing editor of *The Metal Worker*, of New York, brings to his office an unusual equipment gained through many years' experience in the heating trade, having been connected with the Central Radiator Company previous to his appointment as managing editor of *The Metal Worker*. The society is to be congratulated upon securing his services which will insure its advancement on the progressive lines followed by the retiring secretary, Mr. Macon.



JOHN F. HALE, CAMDEN, N. J.
The New President of the American Society of Heating and Ventilating Engineers.

The council also decided by lot the terms of office of its vice-presidents and managers, as follows:

VICE-PRESIDENTS.

Albert B. Franklin, term expires 1914.
Edmund F. Capron, term expires 1915.

MANAGERS.

D. D. Kimball, term expires 1914.
J. M. Stannard, term expires 1914.
W. W. Macon, term expires 1915.
Ralph Collamore, term expires 1915.
Frank T. Chapman, term expires 1916.
Theodore Weinshank, term expires 1916.

An association was formed in Washington, D. C., January 24-25, 1913, of the engineering divisions of the universities and colleges of the United States known as "land grant" institutions. The association will deal with problems peculiar to such institutions by reason of the land grant act under which they are established.

THE HEATING AND VENTILATING MAGAZINE

Vol. 10 February, 1913 No. 2

PUBLISHED MONTHLY AT

1123 BROADWAY, NEW YORK

BY THE

Heating and Ventilating Magazine Co.

President, A. S. ARMAGNAC
Secretary and Treasurer, G. PETERSEN

The address of the officers is the address of this magazine.

A. S. ARMAGNAC, Editor
G. PETERSEN, Advertising Manager

European Representative:
AMERICAN PUBLICATION BUREAU, 304 High Holborn, London, W. C.

Subscription, - - - - -	$1.00 per year
Canada - - - - - -	1.25 " "
Foreign countries, - -	1.50 " "
Back numbers, - - -	15 cents a copy

IT NEEDS no argument to show that a committee or other body engaged in studying conditions involving technical problems should include in its membership at least one technical expert capable of analyzing and explaining the data obtained. This necessity has been demonstrated so often that it would seem to be a self-evident proposition. Yet it is a remarkable fact that in a number of important investigations recently where, in some cases, the engineering practices adopted were the principal causes of the investigation, the personnel of the committees was singularly lacking in engineering representation, so that the conclusions reached have brought the problem but little nearer to a final solution than at the outset. With the appointment of committees of this character on the increase, the matter has reached a point where it has already enlisted the active interest of one of our principal engineering bodies. Probably no subject is being more widely investigated at the present time than the mechanical heating and ventilation of buildings. Heating engineers may render a distinct service to themselves and to the profession at this time by using every effort to see that such committees are not allowed to continue their work without protest, unless they are properly qualified to take up the engineering side, as well as the other phases of the problems under investigation.

WE TAKE pleasure in announcing that we shall shortly publish in book form the interesting series of articles on "Vacuum Cleaning," by Maxwell S. Cooley, which have been appearing in THE HEATING AND VENTILATING MAGAZINE. This matter will be supplemented by a quantity of important data and discussions which will cover every aspect of the subject, including proportions and arrangements of piping systems, forms of vacuum producers, rules for determining sizes of cleaning plants for different types of buildings, tests of complete installations, etc., fully illustrated and accompanied by many tables and charts giving the results of original research work.

We venture to state that the appearance of Mr. Cooley's work will be a convincing demonstration to all concerned that the art of vacuum cleaning, especially in its larger applications, is one that rightly comes within the province of the heating engineer. In this respect, no less than in others, it gives us considerable gratification to be the medium for presenting to the profession the most complete and authoritative treatise on vacuum cleaning that has been published. Further announcement will be made when Mr. Cooley's new work is ready for distribution.

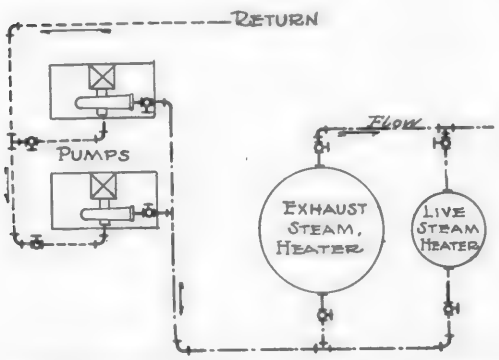
THE CONSULTING ENGINEER

"The Consulting Engineer" is prepared to reply, in this department, to any questions which our readers may ask regarding problems connected with the design and installation of mechanical equipments of buildings.

II—Connections to Circulating Pumps in Hot Water Heating.

QUESTION: In connecting the circulating pumps of a forced hot water heating system, should the water connection be made in series or parallel?

ANSWER: This depends entirely on the characteristic curve of the pumps and the friction head of the piping when delivering the rated number of gallons of the pump. If either pump is capable of circulating the heating water of the entire system and where the required gallons are circulated, and the gauges register the rated head of the pump, the connection should be in series, as greater capacity cannot be obtained efficiently without increasing the head, which in turn cannot be accomplished without adding the heads of the pumps. The slip will be far less with the above arrangement than with parallel connections, under the conditions named.



ARRANGEMENT IN PARALLEL OF PUMPS AND HEATERS FOR FORCED HOT WATER HEATING.

If either pump will only deliver one-half of the total capacity against a head higher than the friction of the piping at the capacity of one pump, or one-half the maximum, and the latter is motor-driven, there is apt to be an overload on the motor, if the outlet is not throttled to increase the discharge head of the pump. This is due to an increase in capacity over the rating when operating under a low head, increasing the horsepower required.

It is the best practice to have each pump capable of handling the water for the entire system with a rated head slightly in excess of the friction head of the piping when delivering the rated capacity. The connections should be made in series so as to obtain efficiently the increased circulation during the short intervals of extreme weather.

The characteristic curve of the pump involved will easily determine what is the best practice in any individual case to obtain the best efficiency. Turbine pumps run off in their efficiency considerably when not properly selected with reference to the capacity and friction head required. There is absolutely no saving on a properly-designed appartus, in regulating the temperature of a hot water system utilizing exhaust steam under vacuum, by varying the circulation. When the exhaust steam is insufficient, the steam from the circulating pump can be utilized for heating and, with a pump 60% efficient the heat units in the steam so utilized between the initial boiler pressure expanded to the final temperature of the exhaust will be somewhat less than the heat in friction returned to the water, represented by the heat units quivalent to the theoretical mechanical work performed.

When the plant is operated with exhaust steam under a vacuum, although the steam used to operate the pump will represent live steam operation, the drop will be less with the greater pumpage and, in many cases, the reduction in final temperature of the exhaust will decrease the steam rate on the main engine, due to a greater vacuum, sufficient to more than pay for the increased power used to circulate the water.

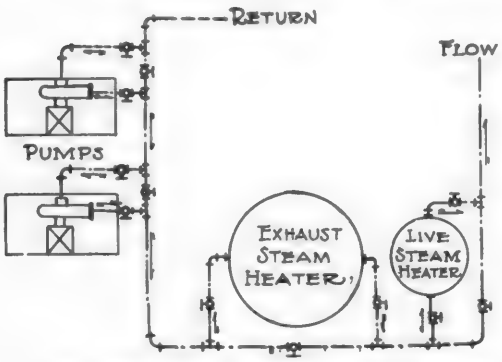
Minimizing the capacity of the pump on a forced hot water heating system is mistaken economy, in nearly all cases, as the size of the mains increase the initial cost and the transmission rate is reduced due to lower velocities, while the radiation of the mains is increased. These items increase in far greater ratio than the cost of the pumping apparatus

Connections Between Live and Exhaust Steam Heaters in Forced Hot Water Heating.

QUESTION: In making the water connections between the live and exhaust steam heaters of a system of forced hot water circulation, which is the most desirable method, parallel or series?

ANSWER: Series, by all means, inasmuch as the transmission of the heating surface of the heater is a function of the velocity. If the current is divided, the velocity will be less in each heater with parallel connections than with series, when both heaters are in commission.

If the heaters were designed for higher velocities when used together, the friction head would be excessive if all the water was



ARRANGEMENT IN SERIES OF PUMPS AND HEATERS FOR FORCED HOT WATER HEATING.

passed though either, operating separately. The method of parallel connections was introduced solely for the purpose of avoiding infringement of the original patents on hot water heating by forced circulation which have now expired.

As a matter of fact, on large plants the live and exhaust steam heaters are seldom used in conjunction, except, perhaps, at night and during periods of light power load. The exhaust heater, under these conditions, ordinarily has many times the capacity of the exhaust steam available.

During day periods, when the main engines are operative, it is more convenient and better practice to vary the back pressure on the engine to produce the proper quantity of steam for heating, rather than operate both heaters in conjunction, whether the connections are in series or parallel.

The above conditions of operation would seldom cause the question to be raised except in the case of the design of a new plant, but the series connections will be found more efficient and convenient and, therefore, better practice.

Current Heating and Ventilating Literature

Under this heading is published each month an index of the important articles on the subject of heating and ventilation that have appeared in the columns of our contemporaries. Copies of any of the journals containing the articles mentioned may be obtained from THE HEATING AND VENTILATING MAGAZINE *on receipt of the stated price.*

CENTRAL STATION HEATING.—Central Station Heating. H. A. Woodworth. Deals with recent practice of heating companies in the matters of plan and equipment. 4300 w. 4 figs. Nat. Eng.—Nov. 1912. 20c.

EXHAUST STEAM.—Cost of Exhaust Steam Heating. Ira N. Evans. Shows how more power can be obtained from the same amount of steam before utilizing it in the heating system. 5,000 w. Power—Nov. 26, 1912. 20c.

FANS AND BLOWERS, SPEED CONTROL OF.—Speed Control of Fans and Blowers. W. E. Thau. Gives comparative costs for different methods. 1,600 w. 6 figs. El. Jl.—Nov. 1912. 20c.

GAS HEATING.—The Hygienic Aspects of Gas for Heating and Lighting in Home, School and Workshop. Vivian B. Lewes. Lecture before the British Commercial Gas Assn. Aims to show that coal gas as now used is hygienic and efficient. 6,000 w. Pl. & Dec.—Nov. 1, 1912. 40c.

VENTILATION.—The New Art of Ventilation; Some Principles which Follow from Recent Physiological Research. C. E. A. Winslow. Paper presented to the International Congress on Hygiene and Demography, Washington, D. C., Sept., 1912. 5,400 w. Eng. News—Nov. 28, 1912. 20c.

SMOKE PREVENTION.—Smoke Prevention. John S. Franklin. A study of fuel combustion, 3,000 words. Cassiers' Mag. Sept., 1912. 40c.

New Rules for Ventilating New York City's School Buildings.

New orders for the operation of the heating and ventilating systems in New York City's public schools, radical to a degree in their reversal of former practice, have been issued to fulfill the provisions of the report of the special committee of the Board of Education on Ventilation of Public School Buildings, John Martin, chairman. Such systems are hereafter to be practically in charge of the principals, to be operated or not at their discretion, while the frequent opening of the windows is not only permitted, but ordered.

Regarding the duties of janitors, the new rules are that "he shall have the temperature of all rooms occupied for school purposes at not less than 58° at 8 a. m. on each school day, and, unless the outdoor temperature be higher, shall maintain the temperature between 60° and 68° F. throughout such rooms, from 9 a. m. until school is dismissed, and the temperature of the gymnasiums, halls and passageways between 60° and 65° F. during the same period. Thermostats shall be set at 65° F.

The principals of the schools are instructed to put into practice the following provisions of the report:

During the two-minute setting-up exercises at 10 a. m., 11 a. m. and 2 p. m. the windows should be opened from top and bottom and remain open for the two-minute period. During every recess, classroom games and other physical training exercises windows should be opened. In any change of classroom the outgoing class should open the windows and the incoming class close them. When a class leaves the room for recess the windows should be similarly opened. During the lunch period the windows should be opened when the class leaves the room, and should be closed long enough before the return of the class to make the room comfortable.

In carrying out the above provisions due care should be exercised in inclement weather.

Transoms and other openings from classroom to hall should be kept constantly open, at least in part. In buildings not having the plenum ventilation in the halls, windows opening from halls to the outside air should be kept open.

When the temperature of a classroom rises above 68° F. the windows should be opened, the heat at the radiators should be turned off, and the principal notified. When the temperature of a classroom falls below 60° F. the pupils should engage in physical exercise, and the principal should be notified.

Appended to the order is a list of schools having artificial ventilation systems that are to be used at the discretion of the principals when inclement weather forbids the opening of windows.

In other school buildings having mechanical ventilation, upon written request of the principal, accompanied by a written assumption of responsibility for keeping the rooms well ventilated by windows, the principal will be allowed full discretion in the use or nonuse of the artificial system. Principals of evening schools are permitted to order the operation of the ventilating systems in the building, within the period allowed for such operation.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

New Members.

The following members were elected on the ballot canvassed December 18:

MEMBERS.

Jean S. Jenson, 431 S. Dearborn St., Chicago; Carl W. Johnson, 644 W. Washington Boulevard, Chicago; James Ambler Johnston, Nat. Bank of Virginia Bldg., Richmond, Va.; Arthur A. Kiewitz, 500 Park Ave., New York; H. W. MacKinnon, 4057 Forest Park Boulevard, St. Louis, Mo.; Francis H. Morgan, 66 Munroe St., Lynn, Mass.; Leon H. Prentice, 328 S. Sherman St., Chicago; William J. Price, 507 W. Jackson Boulevard, Chicago; John J. Raine, G. S. Blodgett Co., Burlington, Vt.; Gilbert Marshall Robinson, 74 Days Park, Buffalo, N. Y.; Edwin A. Scott, 239 W. 39th St., New York; Chester A. Slocum, 39 Cortlandt St., New York; Douglas Sprague, 39 Cortlandt St., New York.

ASSOCIATE MEMBERS.

Alfred Porter Brown, 412 Dearborn Ave., Chicago; P. J. Dougherty, 52 Dearborn St., Chicago; John M. Frank, 154 Whiting St., Chicago; E. Vernon Hill, M.D., City Hall, Chicago; Henry G. Issertell, 527 W. 34th St., New York; Louis L. Narowetz, Jr., 223 W. Lake St., Chicago; Mark L. T. Stevens, Department of Health, Seattle, Wash; James A. Swan, 104 W. 42d St., New York; S. Alfred Witt, 187 N. Dearborn St., Chicago.

JUNIOR MEMBERS.

John F. Hanbury, 500 W. 173d St., New York; Walter F. McKennett, 2 Stanley St., Woodhaven, L. I.; F. Greatorex Purdy, 500 Park Ave., New York.

New York Chapter.

The feature of the January meeting of the New York Chapter of the heating engineers' society was the presentation of the tentative report on proposed requirements for the ventilation of moving picture theatres, by Frank T. Chapman, chairman. This report was discussed at the annual meeting of the society and will require minor amendments before being ready for distribution. The report went into other features of the operation of such places which, when finally adopted, will make it a comprehensive guide for the benefit of owners and others interested.

Announcement was made of the election to membership of J. A. Almirall and C. W. Haensel.

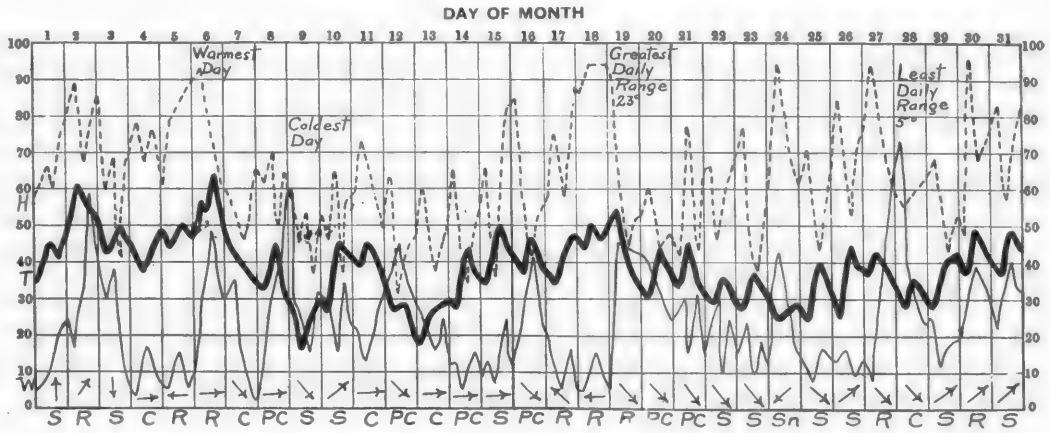
F. K. Davis was appointed to represent the chapter at the funeral of Newell P. Andrus.

Illinois Chapter.

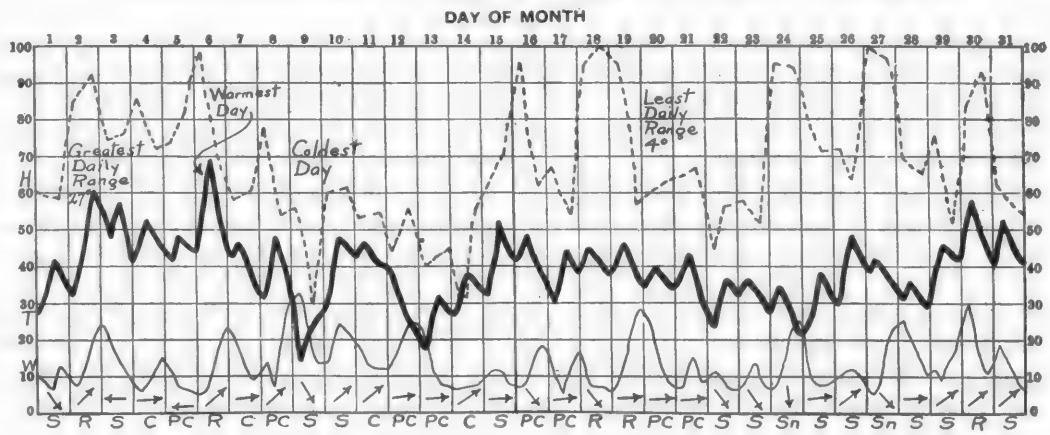
The January meeting of the Illinois Chapter of the heating engineers' society was devoted to a discussion of "The Conditionirg of Feed Water." F. S. Dunham of the Kennicott Softener Co., spoke on the subject of water softeners and William M. Jewell of the Jewell Filtration Co., on filters and their operation. The talks were illustrated by lantern slides. The meeting was in charge of John D. Small, chairman; Charles F. Newport and W. B. Graves.

The Weather for December, 1912

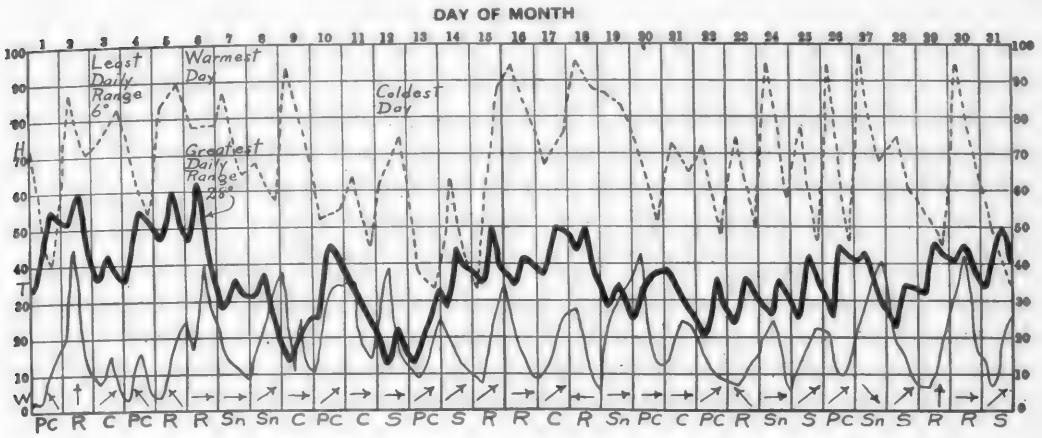
	New York	Boston	Pittsburg	Chicago	St. Louis
Highest temperature, degrees F.	63	69	62	57	66
Date of highest temperature	6	6	6	5	5
Lowest temperature, degrees F.	17	15	12	3	12
Date of lowest temperature	9	9	12	12	12
Greatest daily range, degrees F.	23	27	28	26	33
Date of greatest daily range	19	2	6	2	5
Least daily range, degrees F.	5	4	6	2	5
Date of least daily range	28	20	3	16	29
Mean temp. for month, degrees F.	38.5	38	36	33.4	39
Normal mean temp. for month, degrees F.	34.4	31.6	34.7	29.3	35.5
Total rainfall, inches	4.24	5.36	2.86	1.08	0.42
Total snowfall, inches	11.8	9.2	5.1	Trace	0.1
Normal precipitation, this month, inches	3.45	3.41	2.73	2.07	2.23
Total wind movement, miles	14519	8723	10084	12263	9144
Average hourly wind velocity, miles	19.5	11.7	13.6	16.5	12.3
Prevailing direction of wind	N. W	West	S. W.	S. W.	South
Number of clear days	9	12	6	11	16
Number of cloudy days	10	10	12	13	9
Number of partly cloudy days	12	9	13	7	6
Number of days on which rain fell	9	7	14	9	3
Number of days on which snow fell	1	2	5	Trace	1
Snow on ground at end of month, inches	None	None	None	None	None


DAY OF MONTH
Warmest Day
Coldest Day
Greatest Daily Range 23°
Least Daily Range 5°
H
T
W
S R S C R R C PC S S C PC C PC S PC R R R PC PC S S Sn S S R C S R S

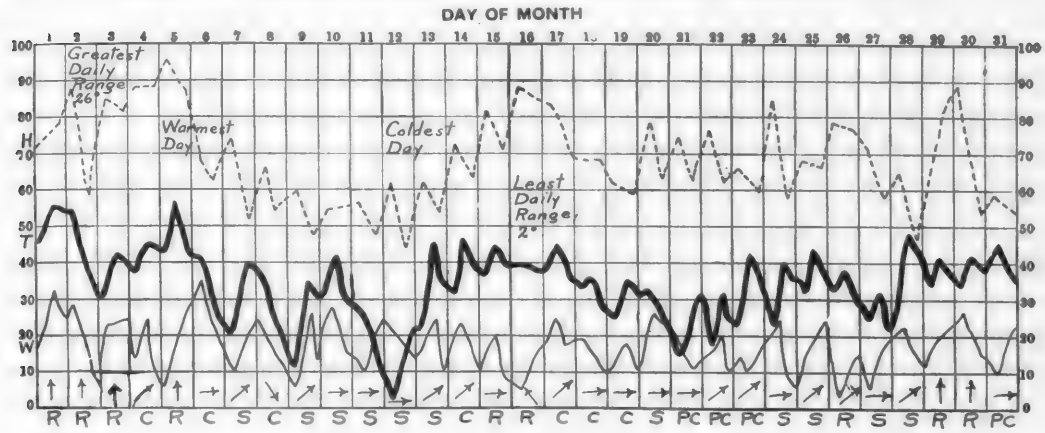
RECORD OF THE WEATHER IN NEW YORK FOR DECEMBER, 1912.
(Hourly observations of the relative humidity are plotted on this chart.)


DAY OF MONTH
Warmest Day
Coldest Day
Greatest Daily Range 27°
Least Daily Range 4°
H
T
W
S R S C PC R C PC S S C PC PC C S PC PC R R PC PC S S Sn S S Sn S S R S

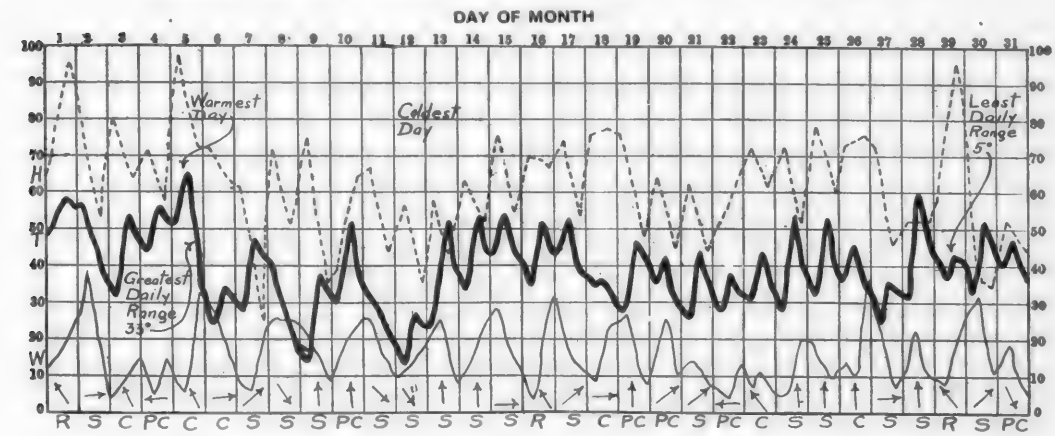
RECORD OF THE WEATHER IN BOSTON FOR DECEMBER, 1912.


DAY OF MONTH
Least Daily Range 6°
Warmest Day
Greatest Daily Range 26°
Coldest Day
H
T
W
PC R C PC R R Sn Sn C PC C S PC S R R C R Sn PC C PC R Sn S PC Sn S R R S

RECORD OF THE WEATHER IN PITTSBURG FOR DECEMBER, 1912.


DAY OF MONTH
Greatest Daily Range 26°
Warmest Day
Coldest Day
Least Daily Range 2°
H
T
W
R R R C R C S C S S S S C R R C C C S PC PC PC S S R S S R R PC

RECORD OF THE WEATHER IN CHICAGO FOR DECEMBER, 1912.


DAY OF MONTH
Warmest Day
Coldest Day
Least Daily Range 5°
Greatest Daily Range 33°
H
T
W
R S C PC C C S S S PC S S S S S R S C PC PC S PC C S S C S S R S PC

RECORD OF THE WEATHER IN ST. LOUIS FOR DECEMBER, 1912.

Plotted from records especially compiled for "The Heating and Ve tilating Magazine," by the United States Weather Bureau.

Heavy lines indicate temperature in degrees F.

Light lines indicate wind in miles per hour.

Broken lines indicate relative humidity in percentage from readings taken at 8 a. m. and 8 p. m.

S—clear, P C—partly cloudy, C—cloudy, R—rain, Sn—snow.

Arrows fly with prevailing direction of wind.

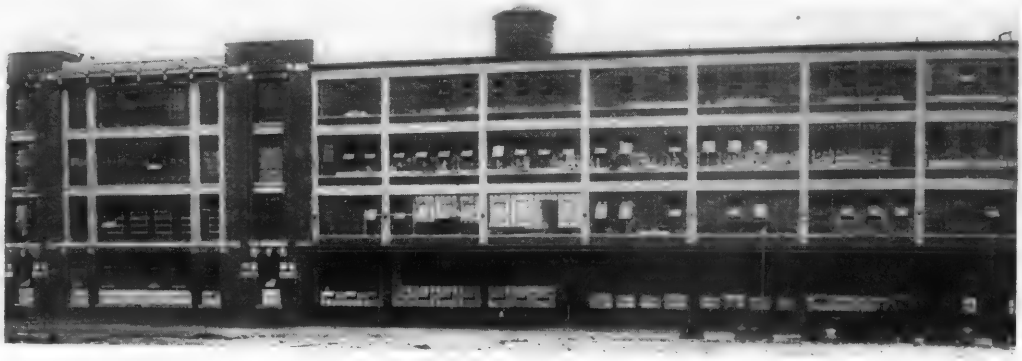


FIG. 1—PORTION OF MACHINE SHOP, FORD MOTOR CO., DETROIT, MICH.

Machine Shop Heating, Ventilating and Cooling on a Large Scale

PLANT OF THE FORD MOTOR CO., DETROIT, MICH.

With the new addition, recently completed, to the Ford Motor Company's plant in Detroit, this concern has a machine shop of immense size, as can be understood from the fact that it is designed to turn out 75,000 automobiles a year. The machine shop itself is 1480 ft. long and from 187 to 335 ft. wide, one story high, of saw-tooth roof construction.

While the expert machinist and mechanical engineer will find much of interest in the shop arrangement and machinery, which are models of the best modern practice, an equally remarkable feature of this plant is the apparatus installed for maintaining an ample and properly-conditioned fresh air supply for the workmen. This installation provides the means both for heating the air in winter and for cooling it in summer and, in addition, for purifying the air and regulating its humidity at all times.

The air distributing system for the old shop consists of a series of overhead galvanized sheet-iron pipes installed in the saw teeth, through the trusses, with branches to alternate columns, staggered. The outlets point straight downward and in general terminate 9 ft. above the floor, as shown in Fig. 2. The shop had already been completed and was in operation when the system was designed, hence the necessity of using the overhead system in this older portion.

In the new shop the distributing system consists of underground ducts, with floor outlets located at alternate columns and staggered as in the old shop. A typical plan arrangement is shown in Fig. 3.

The floor outlets are of novel construction. In nearly all cases, the column is in the center of the outlet, making necessary a sliding sleeve damper as shown in Fig. 4. This damper is designed with a conical deflecting bottom. The lower part is a screen which forms

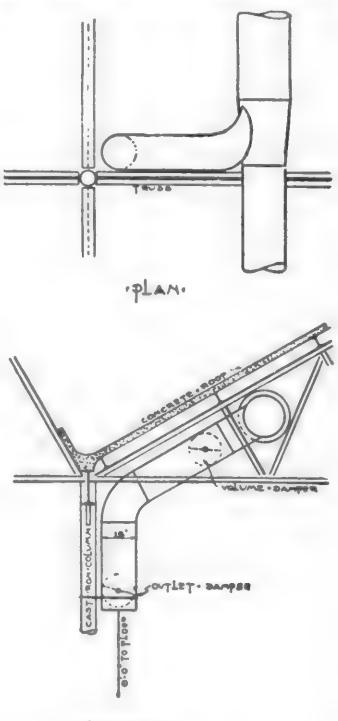


FIG. 2—TYPICAL OUTLET AT COLUMNS IN OLD SHOP.

an exit for the air while the upper part is a galvanized sheet metal cover which slides up and down. The tops of the boxes are of cast-iron and of very substantial construc-

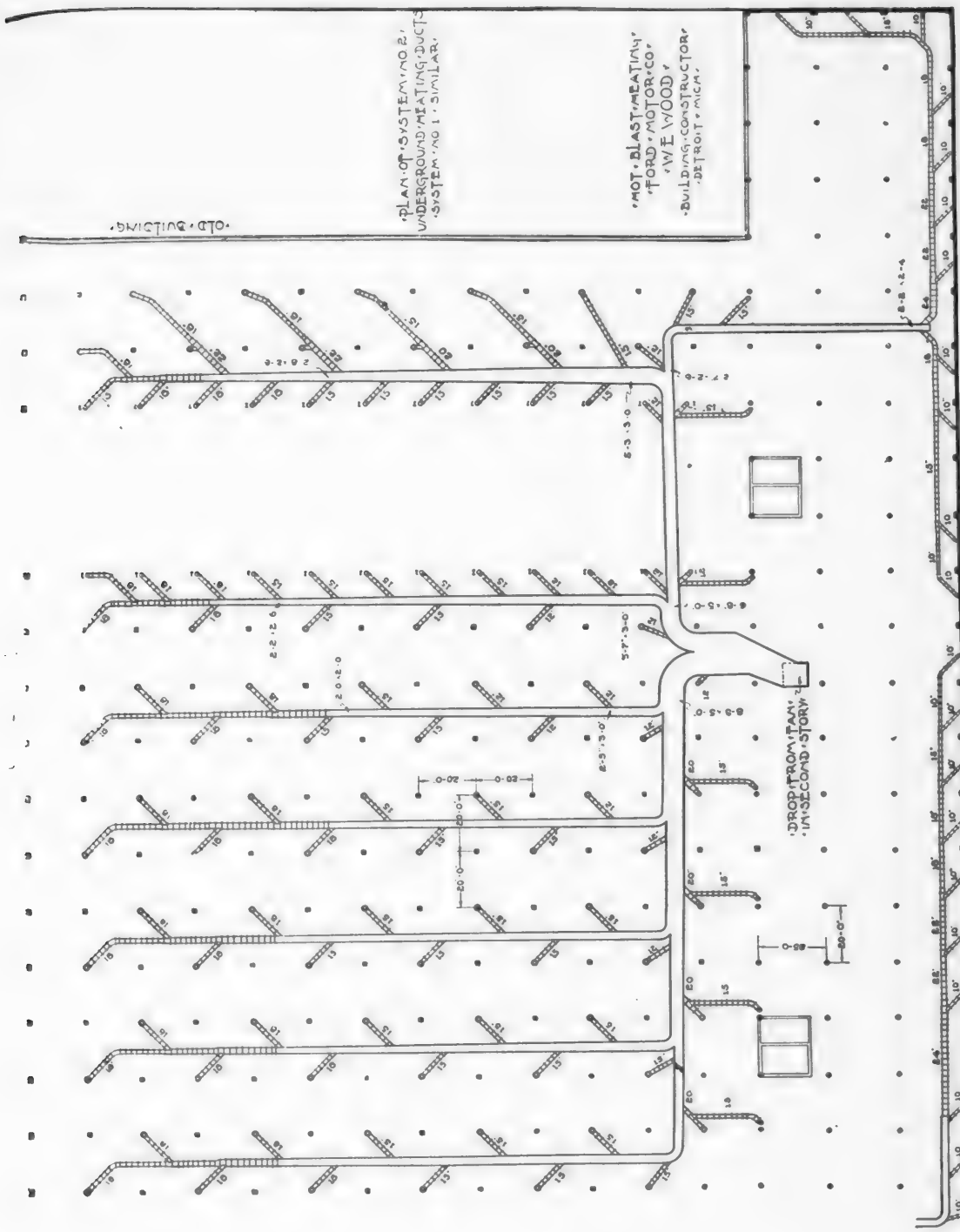


FIG. 3—TYPICAL SYSTEM OF UNDERGROUND HOT AIR DUCTS, PLANT OF FORD MOTOR CO., DETROIT.

tion, as they will, without doubt, be used as shelves to support various articles used in the shop and even for parts going through the manufacturing process. The air velocity at each outlet will not exceed 500 ft. per minute so as not to be objectionable to employees working near it.

All distributing ducts up to 24 in. in diameter are made of vitrified sewer pipe. For sizes larger than this, brick ducts, smoothly plastered on the inside and outside, are employed. The top and bottom of the ducts are of concrete, properly reinforced where

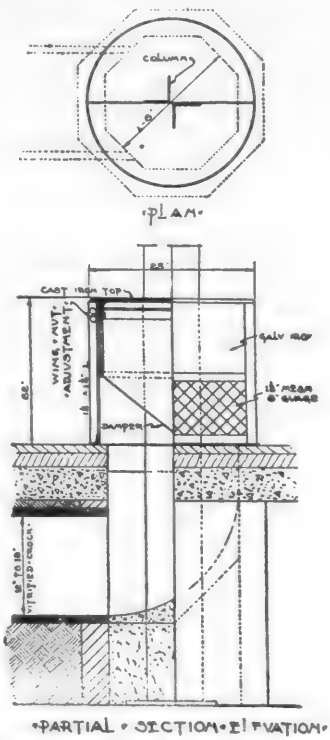


FIG. 4—TYPICAL AIR OUTLET AT COLUMN IN NEW SHOP.

necessary. The duct bottoms all pitch downward toward the lowest point at the base of the fan riser where a water seal is located to take care of any accumulated moisture. The water is pumped from the sump to a sewer by means of a small centrifugal outfit.

FIVE SETS OF APPARATUS USED.

Five complete and separate sets of apparatus are used in this system. Each unit consists of a large Conoidal fan, of Buffalo Forge Company make, belted or motor driven (Fig. 5), a carrier air washer and humidifier, and twelve Buffalo mitre-type wrought-iron heater coil sections designed for hot water radiation (Fig. 7).

A typical plan and elevation view of one of the heater coil sections is shown in Fig.

FIG. 5—ONE OF THE DOUBLE CONOIDAL FANS, NORMAL CAPACITY, 168,400 CU. FT. PER MINUTE.

6. Air is recirculated from the building and mixed with fresh air from outdoors through the dampers which may be regulated to suit the weather conditions. It then passes through the tempering coil, air washer, heater coils, and finally is distributed to the ducts by the fan.

An exterior view of one of the units completed is shown in Fig. 9. At the extreme right are the two sections of tempering coils, next is the humidifier and finally the heater coils. At the extreme left, in the enclosure, is the fan, belt-driven from motor as shown.

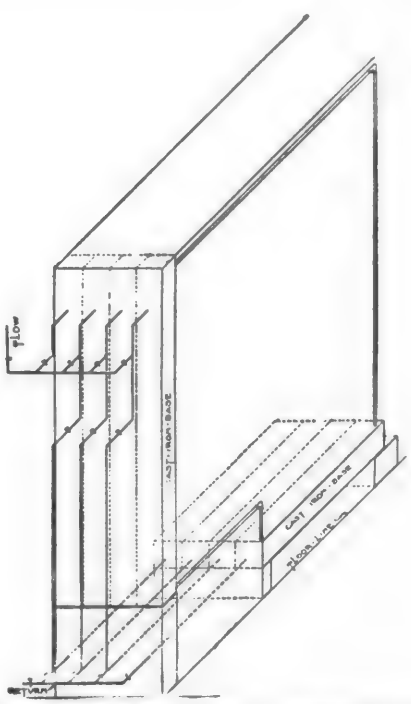


FIG. 6—TYPICAL COIL CONNECTION.

FIG. 7—HEATER COIL SECTIONS IN COURSE OF ERECTION.

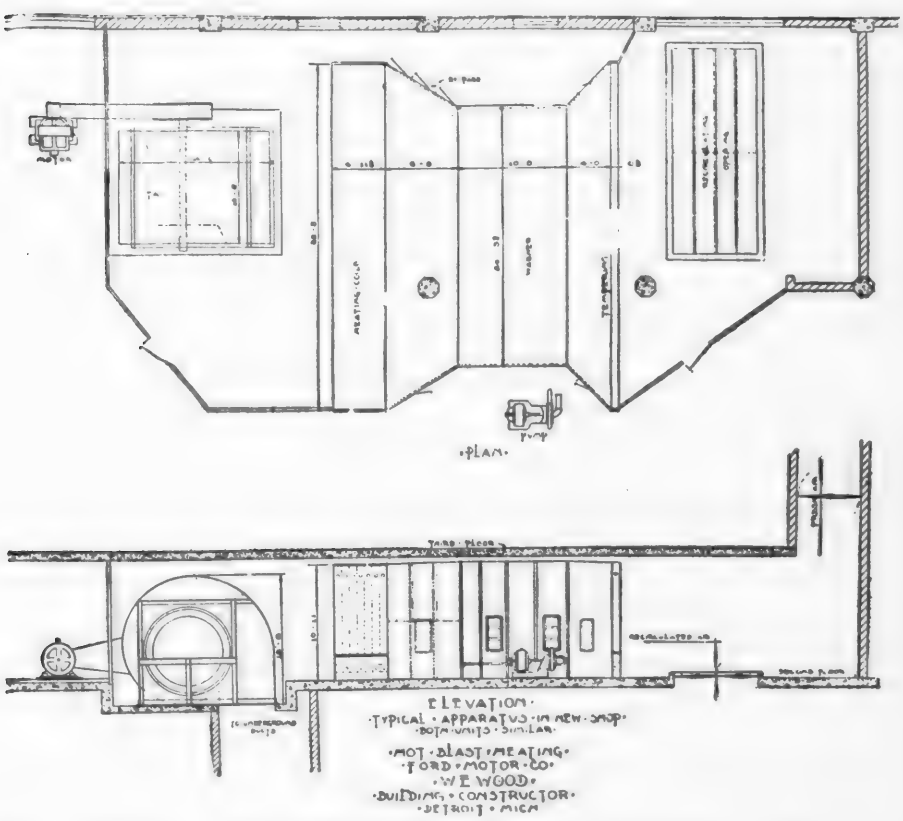


FIG. 8—TYPICAL ARRANGEMENT OF HEATING APPARATUS IN NEW SHOP.

FIG. 9—FINISHED APPEARANCE OF APPARATUS NO. 1.

COOLING ARRANGEMENTS.

On account of the cooling effect desired for summer operation, the standard humidifiers of the Carrier Air Conditioning Company as used for humidifying purposes in woolen and cotton mills are installed. These differ chiefly from the standard air washers in that the atomizing nozzles discharge in a direction opposite to that of the movement of the air, greatly increasing the humidifying and cooling effect, while a double set of nozzles is employed instead of a single set. The water is recirculated from a tank beneath the nozzles through a large gravity strainer by means of a horizontal centrifugal pump direct connected to motor. The pressure maintained upon the nozzles is approximately 35 lbs., varying somewhat in different apparatus.

This system is guaranteed to deliver the air from the washer at not more than 1° F. above the wet bulb temperature of the incoming air. The wet bulb temperature in Detroit very rarely exceeds 75° F., and in the hottest weather is usually much lower than this. Very comfortable working conditions are thus assured even in the hottest weather.

ARRANGEMENT OF HEATER COILS.

The heating medium of each system con-

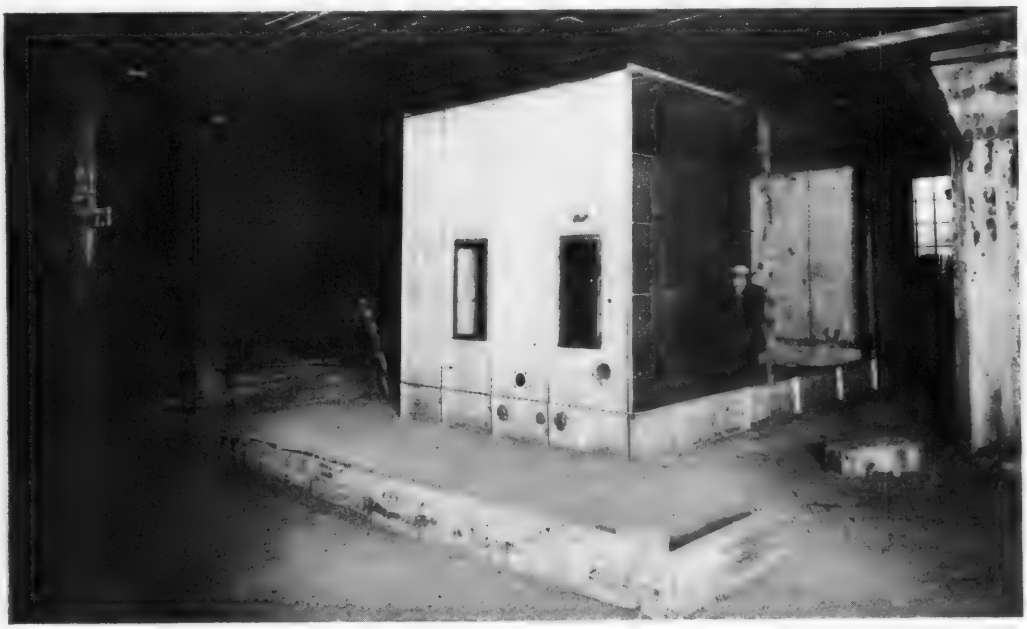


FIG. 10—APPARATUS NO. 2 IN PROCESS OF ERECTION.
Air Washer and Humidifier in Foreground, Heater Coils and Fan in Background.

FIG. 11—INTERIOR OF MACHINE SHOP, PLANT OF FORD MOTOR COMPANY.
Battery of Automatics in Foreground.

FIG. 12—ROOF OVER MACHINE SHOP, PRACTICALLY ALL GLASS.

sists of six four-row sections of heater coils, and one four-row section of tempering coils, the latter designed to raise the temperature of the incoming air above the freezing point before reaching the sprays, but which in general will not be used on account of the large amount of air recirculated. The coils are of the Buffalo standard mitre type. In order to properly adjust the delivery temperature of the water, the pipe connections for the coils are arranged and valved so that they may be connected in series multiple as shown in Fig. 6.

There are over 129,000 lin. ft. of pipe in these heaters or, in other words, if placed end to end, the total length would be about twenty-five miles. The total normal capacity of the fans is 33,000,000 cubic feet of air per hour.

W. E. Wood & Co., engineers and constructors, Detroit, Mich., designed and supervised the installation of this system, the apparatus being furnished by the Buffalo Forge Company, Buffalo, N. Y. and by the Carrier Air Conditioning Company, New York.

Insulating 3,000 Ft. of Underground Steam Piping.

The Berwind-White Coal Mining Company is one of the largest operators in the bituminous field, and in many respects its most interesting operations are in and near Windber, Pa. This town has a population of 12,000 and is situated high in the mountains not far from Johnstown, Windber is practically owned by the coal company and allied interests.

Some years ago the Windber Heating Company was formed and a large power house was built at the entrance of the coal mine. This plant furnished power and light for the operation of the mine, and electric light, power and heat for a large portion of the town. At the present time this heating company is under contract to supply heat for 58,000 sq. ft. of radiation.

In all the early installations the pipe was insulated with wood covering. About a year ago one line was opened up, and the pipe covered with J-M sectional conduit, the construction of which may be noted from the accompanying illustrations. This proved so satisfactory that the company has recently opened up over 2,000 ft. of steam line, taking it from the ditch and relaying it with J-M sectional conduit. Today it has in all a total of 3,325 ft. of the J-M conduit installed.

The recent installation, of which some views are shown herewith, is an 8-in. main line, running from the power house up a steep hill and down a stiff grade to the heart of the town where it connects with the branch mains. There is no return line on this system, live steam being carried into each building at a low point, so that the return will flow back into a trap, from which it is allowed to go to waste.

Several difficult conditions had to be met with, such as the line passing through coal veins and hard pan, a surface through which water strong in sulphur percolated. This chemical-water rapidly ate the steel pipe away where it came in contact with it and it was necessary to remove a considerable quantity of pipe, although it had only been in

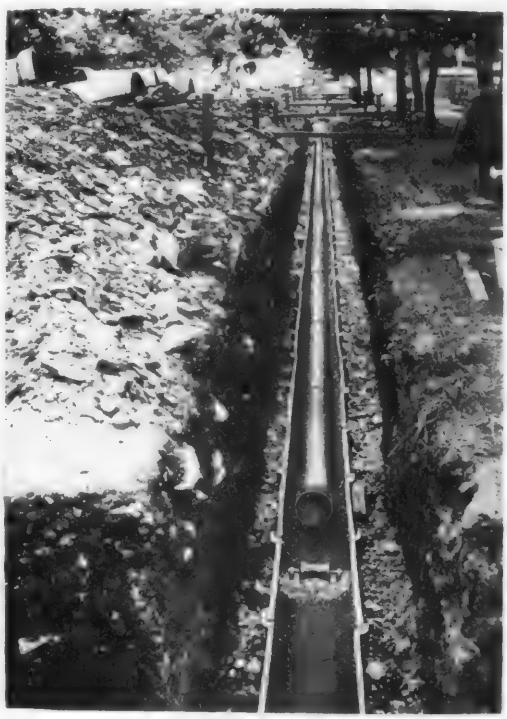


FIG. 1—LOWER HALF OF J-M SECTIONAL CONDUIT, WITH STEAM PIPES PARTIALLY INSTALLED, PLANT OF WINDBER HEATING. CO.

three years. In one place, a hole had been eaten in the pipe nearly 2 in. in diameter.

In laying this pipe line it was originally found necessary to cross under the gutter of a roadway which carried mine water strongly charged with sulphur. In laying the new conduit and pipe at this point, the course of the steam was temporarily diverted while the conduit was laid across its path. A concrete dam was constructed in the gutter with the conduit imbedded in it. This prevented the backfilling from washing away, securely held the conduit in line and kept it free of danger from sulphur water.

As originally laid the pipe was allowed to take the curvature of the ditch, resulting in unnecessary strains being placed on the joints, causing their leaking. In laying the new con-

duit care was taken to secure the correct grade. The ditch was dug 3 ft. wide and to the necessary depth. In the bottom of the ditch another ditch 9 in. deep and 12 in. wide was made. In this was laid a 6-in. diameter sub-drain, the bottom of which was covered with 6 in. of crushed stone of rather coarse grade. Upon this was laid a layer of fine chip stone, to form a fairly even bed for the bottom half of the conduit.

At every fifth section of tile was a supporting tee, with the bell of the branch down, and the base filled to the flow line of the conduit with rich concrete, as will be noted in the illustration (Fig. 1). In this concrete were set J-M roll frames with exactness as to height. These frames are designed to carry the entire weight of the pipe and permit it to move under expansion and contraction without placing any strain on the tile conduit shown in foreground of Fig. 1.

The steam pipe was then laid and the expansion joints were placed in the line at proper intervals, to take care of the expansion and contraction of the pipe. All expansion joints were placed in manholes. Then the pipe was subjected to a hydraulic water test of 20 to 60 lbs. according to the steam pressure to be carried in the line where the test was made.

The top halves of the conduit were next

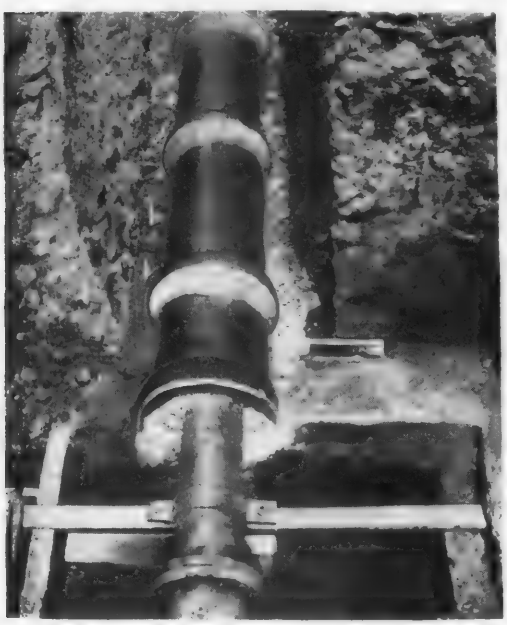


FIG. 2—COMPLETED INSTALLATION AT MANHOLE, PLANT OF WINDBER HEATING CO.

placed in position, the longitudinal joints being washed with neat cement mortar and the bell joints cemented to insure their being watertight.

J-M asbesto-sponge filling was packed in the conduit all around the steam pipe (as shown in Fig. 2), after each top section had been secured in place. Crushed stone of medium size was then filled in until the bells of the second half were covered with 3 in. of stone. Then the ditch was filled up and tamped.

The manholes were made with 13 in. concrete foundation walls to a height even with the top of the lower half of conduit. The conduit was brought through the manhole walls, so that the edges of the tile were flush with the inside of the walls. In order that the tile should have bell ends in the manholes, unions were used in laying the first sections on the down grade side of all manholes. Over these concrete foundation walls, brick walls were built and brought in at the top to the proper size to receive the manhole plates. Wherever the tile entered the manholes the pipes were covered with sleeves of J-M sectional asbesto-sponge felted pipe covering and the openings around same closed with a shutter.

Cleveland's Municipal Heating Plant.

Mayor Baker of Cleveland, O., in his annual report, has some interesting things to say regarding the experiment being tried in that city of supplying steam for heating purposes from a plant owned by the city. The project, it will be remembered, originated through a request on the part of the trustees of the Cleveland Museum of Art, for the permission of the city to erect in Wade Park a heating plant, so as to avoid the necessity of installing a large smoke-stack in the museum itself. In order to avoid placing a power plant in Wade Park at all, the solution was adopted of installing new boilers and equipment in the Fairmount pumping station in the East End, from which it was arranged to distribute steam for heating not only the museum but also such private houses, places of business and apartment houses as come within the radius of efficiency for live steam distribution.

"The distributing system of this first municipal heating plant," comments the mayor, "has been installed; work is progressing upon the installation of additional boiler capacity and, in the meantime, steam is being supplied to a number of takers from the old boilers in the Fairmount station, where there is an excess of boiler capacity above the present needs of the water department.

"As yet," he continues, "it is impossible to say what the economy of this plant will be, but I call the council's particular attention to the experiment, both because it is conducted under excellent conditions for deter-

mining the possibilities of municipal development in this direction, and also because it seems to me that the attack upon the smoke problem is to be materially aided and the greater convenience and economy of city life much promoted by further municipal activity in the establishment of plants for the distribution of steam for heat. I think the city is doing nothing at this time more interesting or more promising."

Modern Vacuum Cleaning Apparatus

3—Moorhead Vacuum Cleaning Machines.

In the construction of both the Moorhead rotary and reciprocating types of vacuum cleaning machines made by the American Rotary Valve Co., Chicago, the separation is mechanical, thus doing away entirely with screens, cloth bags and strainer plates.

In these machines, the air and collected sweepings are carried through the system of piping directly to the base of the machine, passing through the mechanical separator, which is submerged in water. The dirt, dust and bacteria are mixed with the water, and held in solution in the base of the machine. The air bubbles are broken up, and the air passing through the water is scoured and purified before being taken into the pump and exhausted to the atmosphere.

This arrangement is especially designed to secure a perfect separation, so that no dirt or dust will be carried to the pump, providing, among other things, a long life for this part of the apparatus. Screens, cloth bags and strainer plates have a tendency to become heavily coated or clogged with collected dirt or dust. The elimination of such devices in the Moorhead machines is important, permitting them to operate at the highest constant efficiency.

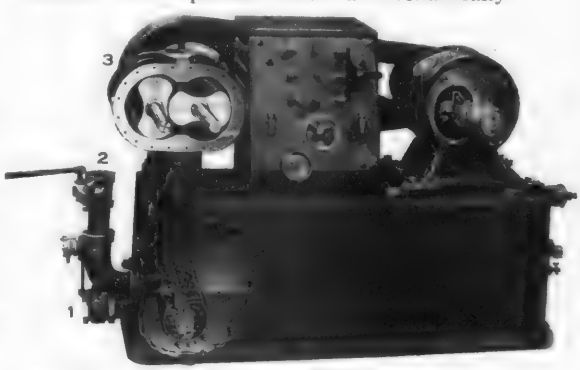
The method of cleaning these machines is also mechanical, and they require no hand cleaning at any time. This method of cleaning is accomplished by reversing the action of the pump, which converts it from a vacuum producer to an air compressor, and the contents of the base, when necessary, are discharged direct to the sewer under force of compressed air.

The entire operation of cleaning out the machines and putting them in readiness for operation on vacuum, is accomplished in about three minutes. The sanitary method of disposing of the collected sweepings is one of the strong points of this type of apparatus.

Another feature is that it is possible to utilize the compressed air for cleaning purposes. In a number of installations the pipe has been extended to the garage, and with the compressed air feature, in addition to the vacuum, it has enabled owners to keep their cars in much better shape than has heretofore been possible. The compressed air is also very desirable for use in blowing the collected dust from overhead pipes in the basement; also for cleaning radiators, and getting into close places which it is impossible to reach with a vacuum appliance.

The rotary type machine as manufactured by the American Rotary Valve Co., is made in one and two sweeper capacities, suitable for schools, hospitals and small hotels and residences.

The reciprocating type machine represents a high standard in vacuum cleaning machines, and is the type which is now being installed in the New York Post Office. These machines are operated with a mechanically-



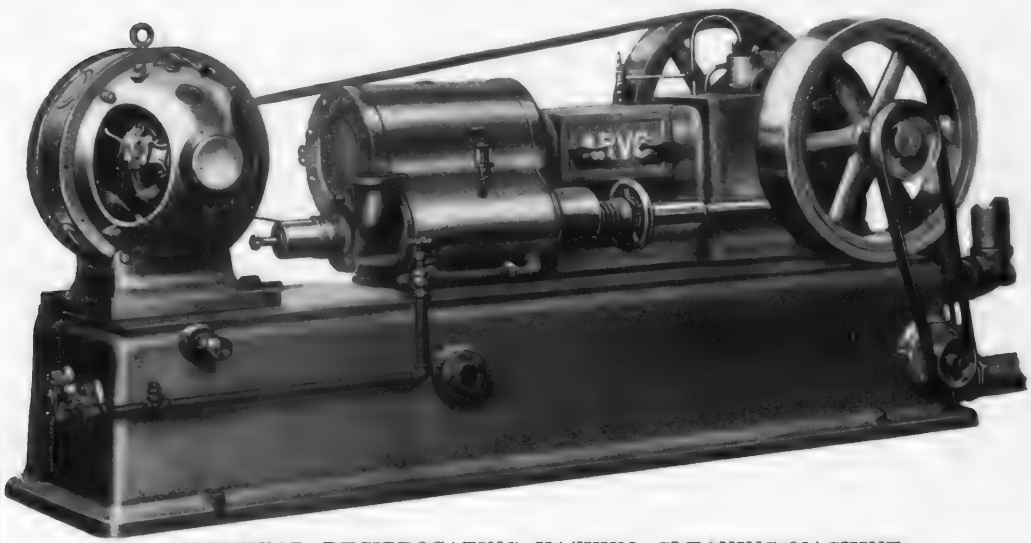
MOORHEAD ROTARY VACUUM CLEANING MACHINE.

moved rotary valve, which insures high mechanical efficiency. There are no valve springs or small internal parts.

The oiling system of this machine is automatic, and shortly after starting up, every moving part is being properly lubricated. Other points mentioned in connection with this machine is that it is noiseless and requires no attention during the operation of sweeping.

The regulating feature of this machine is a point which has been carefully worked out. By means of this regulator, the vacuum under which it is deemed advisable to work to meet the various requirements, can be adjusted and will remain constant until readjusted. Any vacuum required up to 20 in. can be constantly maintained.

The displacement of air is also properly regulated, and at no time is there more air being pumped than is required by the number



MOORHEAD RECIPROCATING VACUUM CLEANING MACHINE.

of sweepers in operation. This reduction is proportionate, and results in a saving in consumption of power when fewer sweepers than the capacity of the machine are in operation.

The company's reciprocating type vacuum cleaning machines are installed in large office buildings, public buildings, hotels, hospitals, mills, factories, and theatres, and are manufactured in capacities to take care of buildings of any size. The apparatus installed in the New York Post Office is a notable example, this being the largest vacuum cleaning machine in the world.

4—Invincible Vacuum Cleaner.

Invincible vacuum cleaners are built on the centrifugal turbine principle with multi-stage impellers; in other words, they consist of a system of rotating impellers or fans. In addition, they are equipped with discharge vanes or conversion vanes designed to utilize the kinetic energy due to high velocities at impeller discharge. The introduction of conversion vanes is designed to increase the efficiency, thus obtaining low power consumption. They are all built to operate on moderate vacuum, 6 in. of mercury being the maximum rating.

The stationary machines range in capacity from single sweepers, driven by ½-H. P. motors to six sweepers, driven by 15-H. P. motors, and still larger sizes when requirements demand them. All stationary machines are horizontal, with impellers mounted directly on the motor shaft and are provided with ring oiled bearings with large oil reservoirs and ball thrust bearings to take up whatever end thrust there may be.

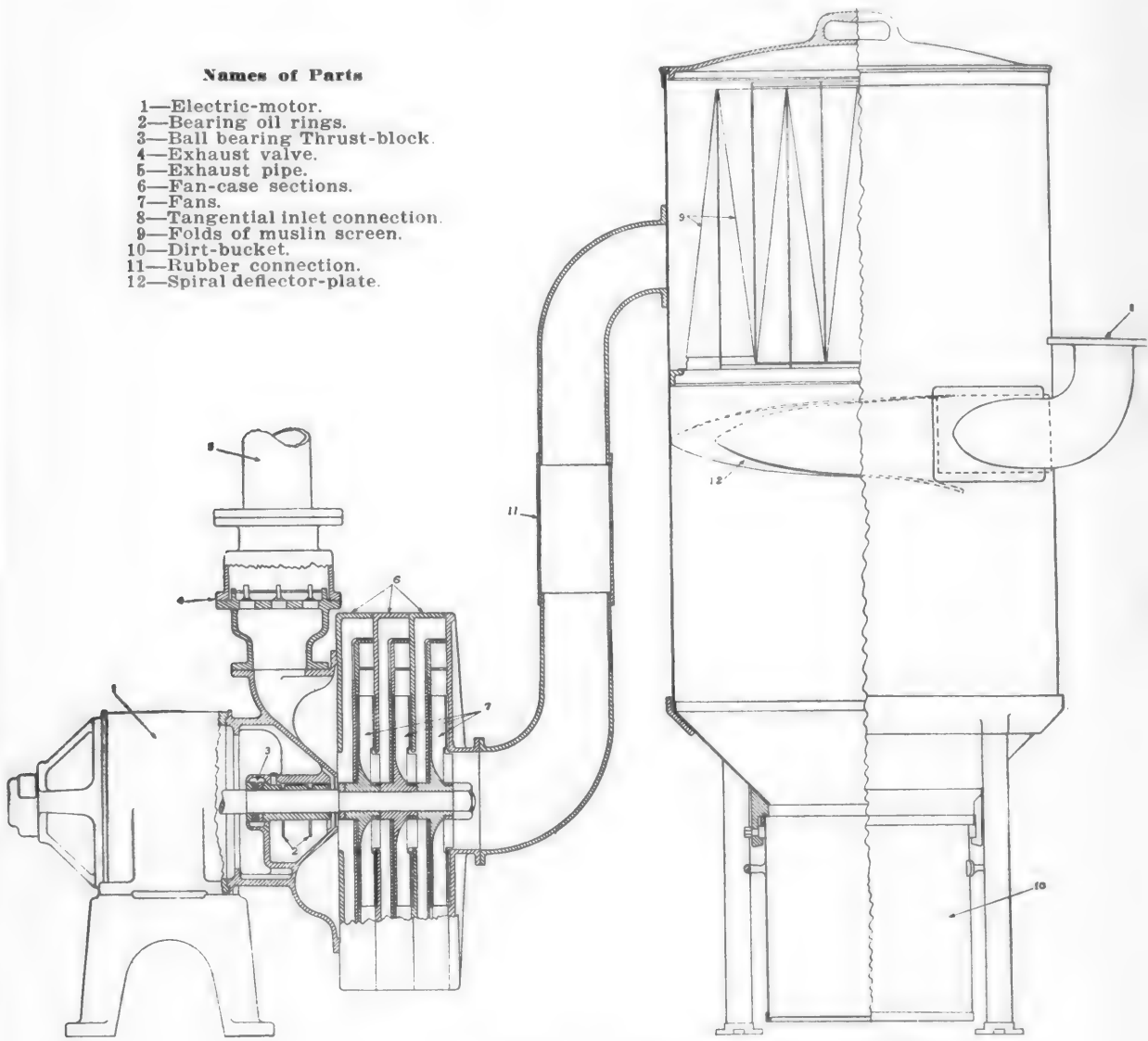
All stationary machines above one-sweeper capacity are provided with combined centrifugal and cloth bag separators in which the centrifugal separator first receives the dirt being designed to separate about 95% of it from the air. The remaining 5% rises to the upper part of the separator and is strained out by means of the cloth separator of large area, allowing the clean air to pass out into the discharge pipe. There is sufficient pulsation in the flow of air at light loads to automatically clean the cloth separator. The dirt collects in a large bucket located at the bottom of the separator, which may be detached from the sepa-

CAPITOL-INVINCIBLE 1 H.P. TRUCK MACHINE, THREE-FAN, DIRECT CONNECTED.

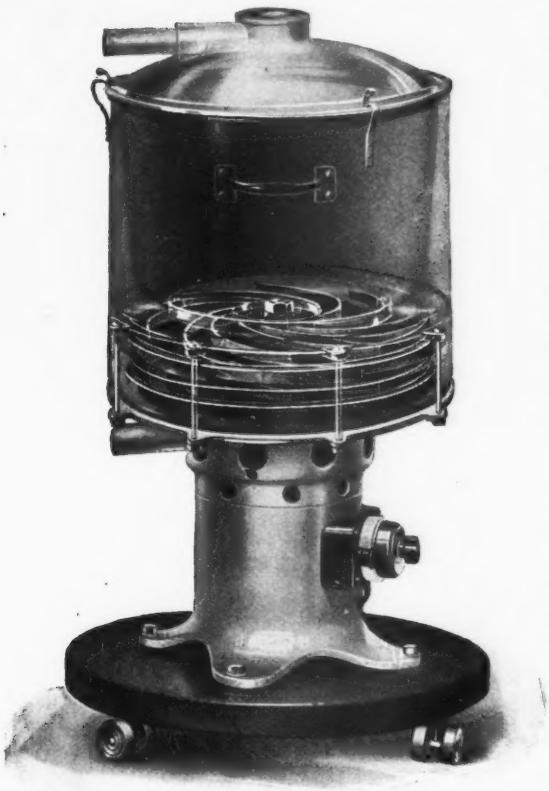
rator by a cam arrangement, so that it may be emptied at will. The smaller stationaries have a simple cloth bag separator which may be taken out and emptied.

The Invincible truck machines were designed to meet the demand for an efficient and light semi-portable machine for office buildings, hotels, etc., where elevator service is available for taking them from one floor to the other. They are built in three sizes: No. 1, No. 2 and No. 2½, driven by ½, 1 and 1½-H. P. motors, respectively. These truck machines are especially for use in old buildings not piped for vacuum cleaners as they supply a cleaning efficiency equal to that of the more expensive stationaries and without the necessity of installing expensive piping.

The Invincible line also includes five sizes of portable machines, ranging in weight from 10 to 40 lbs. The 40-lb. machine (Invincible No. 15) is designed for



CAPITOL-INVINCIBLE STATIONARY VACUUM CLEANING MACHINE.



CAPITOL-INVINCIBLE TWO-STAGE JUNIOR PORTABLE VACUUM CLEANER, SHOWING FANS.

use with a hose and ordinary cleaning tools and is driven by a ¼-H. P. A. C. or D. C. motor.

Invincible renovators are manufactured by the Electric Renovator Mfg. Co., Pittsburgh, Pa.

The selling agent is the United States Radiator Corporation, Detroit, Mich.

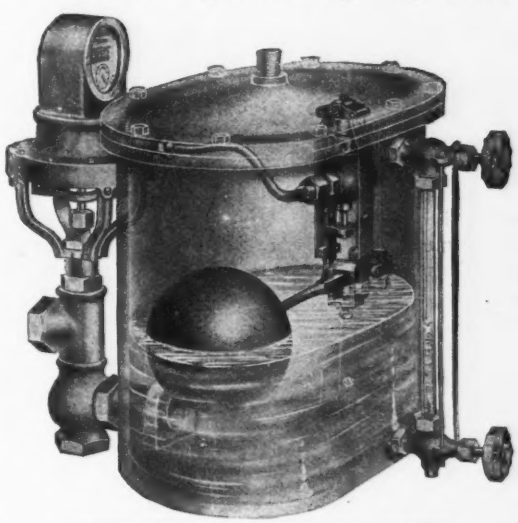
Specialties for Central Heating Plants.

A new type of steam condensation meter, designed to operate by some outside force on the theory that no meter, dependent upon the static head of condensation being measured, can be positive or continuously accurate, has been designed by the W. H. Schott Co., of Chicago, designers and builders of central heating systems. It is known as the Trapand meter, being a trap and meter combined. The use of outside force for impelling the meter has been found to give a positive operation resulting in continuous dumping and registering. Pressure is maintained on the diaphragm valve, operating the meter by conection to city water pressure.

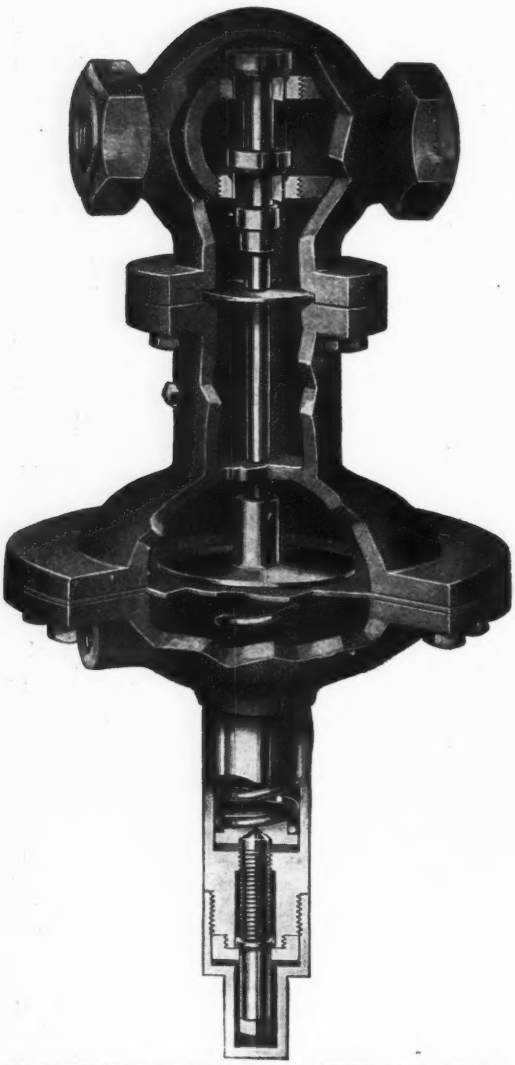
Some of the advantages cited for this type of meter are: trap and meter combined, thus eliminating two devices, with two sets of connections; reliability in dumping, making it positive and constant; and elimination of mistakes in meter readings, because of the direct reading dial. The Trapand meter is a machine shop product and emphasis is laid on the care with which it is built. The springs and bearings are of phosphor-bronze. Another noteworthy device made by the W. H. Schott Co. is a differential control valve for hot water heating plants. It is intended to be installed on the ingoing service pipe, to control the amount of water passing through the individual jobs, regardless of changing of extreme conditions. The valve, as shown, is adjustable, and any desired differential or circulating pressure may be obtained by the spring adjustment. Owing to the sensitive diaphragm construction of this valve, a given differential is maintained on the jobs, although the pump pressure at the station may be reduced or increased, as weather conditions require. The advantage claimed for this arrangement over the use of throttling valves, retarders, equalizers, discs, etc., is, among other things, that they make a fixed condition, which changes according to pump pressure, while the control valve automatically maintains a fixed differential.

It is stated that with a complete installation of these valves, from 15% to 35% of the pumpage may be saved. A part of this reserve pumpage and pressure naturally and automatically builds up the pressure on overloaded lines and at the extreme ends, where frequently it was impossible to give the consumer pressure enough to maintain a good circulating pressure.

The pressure reducing valve, another product of this company, here shown, is of unique construction because of the complete elimination of any levers, weight adjustments



THE TRAPAND STEAM METER.



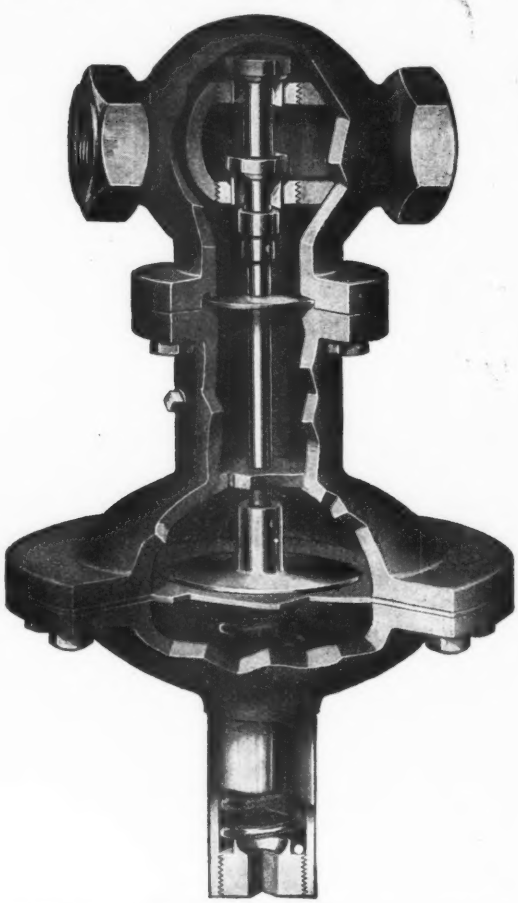
SCHOTT DIFFERENTIAL CONTROL VALVE FOR CENTRAL STATION HOT WATER HEATING.

and stuffing boxes. This feature, together with its simplicity has been found effective in rendering the valve sensitive, constant and positive in its operation. The necessity for an extremely sensitive and reliable reducing valve is brought about by the popularity of the atmospheric system of heating, in which it is imperative that the pressure remain constant and within very narrow limits, as otherwise, the principle of the atmospheric system would be defeated.

New Patent.

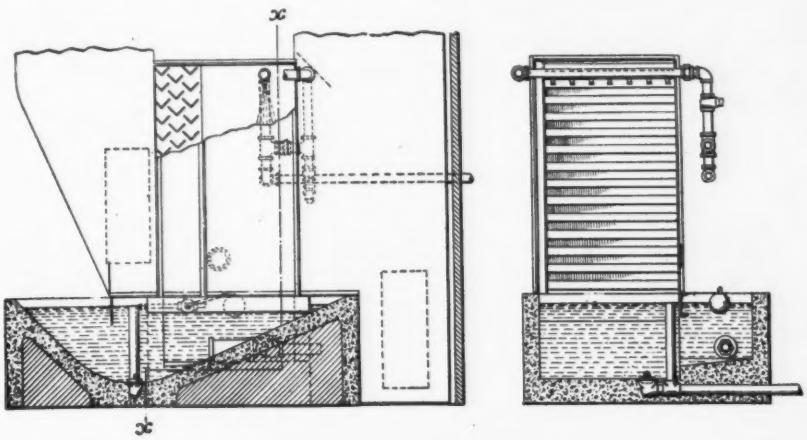
A new patent on the construction and arrangement of an air washer for use in connection with a dust removal system, for washing out the dust particles from the air, has been patented by William G. R. Braemer (Patent No. 1,040,499) assignor to Warren Webster & Co., Camden, N. J. The apparatus is designed to be employed in mills where dust or fine particles are carried by the air from the machines. With the new arrangement, such dust is subjected to a purifying treatment by water sprays, the suspended dust or particles being washed out of the air and collected in a reservoir of water from which it may be recovered. More particularly, the invention is intended for use in conjunction with a usual form of dust and shaving exhauster and collector, so that the air which is treated to the water spray will have been separated from the heavier particles of suspended matter before being washed.

The invention covers a conduit leading from the mill and through which air is forced under the action of a blower, combined with a centrifugal dust separator for removing heavy suspended matter on its way through the conduit. The air washing apparatus is at the discharge end of the conduit, and is of special construction, being made with a



SCHOTT PRESSURE REDUCING VALVE FOR CENTRAL STATION STEAM HEATING.

concrete tank, the bottom of which inclines from each end and is rounded on the lower portion so that the dust washed out of the air will settle to the lowest portion of the tank and may be raked forward up the incline and out through a portion left open.



ARRANGEMENT OF AIR WASHER FOR USE IN CONNECTION WITH EXHAUST DUST REMOVAL SYSTEMS.

ADVERTISERS' INDEX

Alberger Pump & Condenser Co..... 10
American Blower Co..... 62
American District Steam Co..... 10
American Radiator Co.....Back Cover
Applied Heating and Ventilation..... 66
Armstrong Cork Co..... 58
Armstrong Mfg. Co..... 57
Bicalky Fan Co..... 12
Binders for THE HEATING AND VENTILATING MAGAZINE 67
Books on Heating and Ventilation 72
Bound Volumes, HEATING AND VENTILATING MAGAZINE 59
Bristol Co., The .....Front Cover
Buffalo Forge Co.....Inside Back Cover
Carrier Air Conditioning Co. of America, Inside Back Cover
Central Station Steam Co. 60
Chicago Pump Co..... 67
Connersville Blower Co..... 3
Dixon Crucible Co., Joseph..... 65
Dunham Co., C. A..... 12
Fischer-Sweeny Bronze Co. Inside Front Cover
Foster Engineering Co..... 68
*Garden City Fan Co..... 62
Globe Ventilator Co. .....Front Cover
Green Fuel Economizer Co..... 8
Gurney Heater Mfg. Co. ....Front Cover
Hackney Ventilating Co..... 69
Harrison Safety Boiler Works..... 9
Ilg Electric Ventilating Co..... 4
Industrial Instrument Co..... 60
Jenkins Bros..... 59
Johns-Manville Co., H. W..... 60
Johnson Service Co..... 71
Kelsey Heating Co..... 74
Knowles, Geo. E.....Front Cover
Leiman Bros..... 66
McCreery Engineering Co..... 65
Marsh & Co., Jas. P. 69
Michigan Pipe Co.....Front Cover
Monash-Younker Co..... 56
Morehead Mfg. Co..... 5
Mouat-Squires Co. 3
Mueller Mfg. Co., H..... 68
National Steam Specialty Co..... 64
Patterson & Co., Frank L..... 70
Powell Co., The Wm..... 66
Ross Valve Mfg. Co. .....Front Cover
Sturtevant Co., B. F..... 63
Thomas & Smith..... 73
Webster & Co., Warren..... 6-7
Wyckoff & Sons Co., A. 61
*Zellweger & Sons, J..... 70

*Every other month.

THE LARGEST BANK and OFFICE BUILDING IN THE WORLD

TO BE EQUIPPED WITH

THE MONASH NOISELESS SYSTEM OF VACUUM HEATING

THE CONTINENTAL and COMMERCIAL NATIONAL BANK BUILDING CHICAGO
Hanley Casey Co., Heating and Ventilating Contractors, Chicago

D. H. BURNHAM & CO., Architects, Chicago, through their Board of Consulting Engineers and the Investigating Committee appointed by the Bank, adopted the MONASH NOISELESS SYSTEM of VACUUM HEATING for the CONTINENTAL & COMMERCIAL NATIONAL BANK BUILDING, which covers an entire city block, the largest building of its type under one roof in the world.

New York **MONASH-YOUNKER CO.** **Chicago**

121 W. 42nd St. **1420 W. Jackson Blvd.**